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TEXT BOOK

OF

ABDOMINAL SURGERY

A CLINICAL MANUAL
FOR PRACTITIONERS AND STUDENTS

BY

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ASSISTED BY

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WITH ILLUSTRATIONS

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"All diseases should be described as objects of natural history. In writing therefore such a natural history of diseases, every merely philosophical hypothesis should be set aside, and the manifest and natural phenomena, however minute, should be noted with the utmost exactness."—SYDENHAM.

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PREFACE.

It is sometimes of advantage to systematise our knowledge of an advancing art, especially when it is one of recent and rapid growth. This has been the case with the Art of Surgery as applied to the Abdomen.

It may be said that before 1860 abdominal surgery was unknown, or at least was universally condemned. For the next fifteen or twenty years it was almost entirely confined to the removal of tumours of the ovaries; and it was not until about the year 1880 that operations on other abdominal organs became at all general. Now, such operations have been performed on every organ in the abdomen.

This volume is intended to show the present state of our knowledge of Abdominal Surgery. In doing this, we might have contented ourselves with making a mere compilation and comparison of the observations and practice of others, for we have seen the abdomen opened by some eighty or ninety different operators; but we have preferred, while undoubtedly indebted to others, to draw very largely on our own experience and methods. We have done this partly in the belief that personal experience is of more value than the most elaborate and careful

compilation, and especially because, owing to the most intimate professional relations with Dr. Thomas Keith, extending over a period of seventeen years, our experience is based on the work of a surgeon whose early results—about 15 per cent. mortality after ovariotomy—were considered, at the time, so remarkable that they were described as "doubtful," and whose later results have been called "phenomenal."

We desire to acknowledge our indebtedness to Dr. Douie of Sevenoaks, and to Dr. Simpson of Tunbridge Wells, for much valuable help, and also to Dr. Hepburn, who has been kind enough to revise the greater part of the surgical anatomy.

42 Charles Street, Berkeley Square, W.,
June 1894.

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ABDOMINAL SURGERY.

SECTION I.

THE SURGERY OF THE ABDOMEN.

ABDOMINAL SURGERY.

CHAPTER I.

INTRODUCTION.

The General Examination of the Abdomen.

Surgeons are often prone to give too little heed to the history of the ailments of patients, on the score that so many of the symptoms described are imaginary, or at least have no bearing upon the case as it comes before them. While too much importance attached to such description is apt to lead one astray, much information may often be gained to facilitate a correct diagnosis.

After inquiring as to the age and state of the general health previous to the present illness, and into the family history, we next find out how long it is since the patient felt quite well, and what first drew attention to the abdomen; was it discomfort, pain, or swelling? If discomfort or pain, what was its character, and what was its situation; if a swelling, where was it first noticed, did it grow rapidly, or continuously, or rather by fits and starts, or did it alter in size or place at different times? Has the illness made it necessary to remain

in bed, and if so, for how long and on how many different occasions?

While we are being told this history, we notice the general appearance of the patient, the expression and colour of the face, the state of the breathing, and the position assumed, more particularly when in bed. This leads to the special examination of the abdomen itself, and as there are certain points in this examination common to all cases they must now be shortly considered.

The abdomen must be thoroughly exposed, the patient resting on a firm bed or couch with the shoulders low and the lower limbs extended. The position usually recommended is that the shoulders be raised and the legs drawn up, but this does not accord with our experience, especially in cases where there is any suspicion of the presence of free fluid in the peritoneal cavity.

The diagnosis of diseased conditions within the abdominal cavity is not always easy; in some cases it is well to examine the patient two or even three times before making up one's mind, and no pains must be spared to arrive at an accurate diagnosis. A life may be sacrificed by advising against operation, or it may be unnecessarily endangered when an exploratory incision is lightly recommended. This is not all, for the misery entailed by an exploratory incision is very great; there is first the suspense before the operation; and when it is over and nothing achieved, there is the dashing to the ground of all hope, after the courage has been screwed up and great things expected; and there may be the discomfort of a ventral hernia, in addition to other woes.

When an abdominal swelling is examined, we must not content ourselves solely with the question of the nature of the growth and from what part of the body it has sprung; but an endeavour should always be made to determine the exact connection of the tumour; and in a great majority of cases it is possible to do this with wonderful exactitude. In

itself it may not be often of great importance, but such an examination renders one at least more exact in the matter of diagnosis.

First notice the general appearance of the abdomen as regards shape, the state and probable thickness of its wall whether natural or due to œdema, the appearance of the umbilicus, the presence of a swelling at any one part—including the possibility of the presence of a hernia—as well as the condition of the thoracic walls, and in fact everything abnormal. Continuing the examination, the hands comfortably warm are to be laid gently on the abdomen, bearing in mind that all pressure which may be required must be made steadily and evenly. Extreme gentleness is never more necessary than in the examination of the abdomen ; tumours are not infrequently ruptured, peritonitis lighted up, and even if such serious results do not follow rough manipulation, the patient may be unnecessarily alarmed and may lose faith in the ability of the surgeon. If the swelling be of such size that it can be easily felt, the first point to determine if possible, is from what part of the peritoneal cavity and from what organ does it take its rise. Next, we ascertain its consistency, whether solid or fluid or a combination of both ; whether its surface is regular or irregular ; whether fixed or movable ; sensitive or insensitive. When there is difficulty in finding the swelling on account of its small size, the whole abdomen must be carefully gone over, and, as the one hand is moved gently onwards, the other is kept firmly on the abdomen to prevent any small growth slipping over to the part already examined. In our experience rectal examination seldom gives much information, but it must always be resorted to when there is any doubt as to the nature of any growth connected with the pelvis.

Vaginal examination combined with one hand on the abdomen gives a vast amount of information in cases where growths originate in, or have any connection with the pelvis. Here too, examination must be conducted with great gentleness,

especially when the presence of a small inflammatory swelling in the pelvis is suspected. The following incident illustrates well the danger arising from want of this care. An examination of a small tender swelling in the pelvis was made under ether by two gynæcologists. Next day the abdomen was covered with bruises, there was very great pain, the temperature rose rapidly, and the patient barely escaped with her life from an attack of acute general peritonitis.

It is rarely necessary to make examinations under ether, for a diagnosis can usually be arrived at without making the patient insensible. If an anæsthetic did no harm it might be used for convenience, but, by its administration, the safeguard of pain in the sensitive part is lost, and pressure may be applied which no tender swelling ought to be made to bear. Without an anæsthetic, the patient by tightening the abdominal muscles prevents much injury being done during an examination.

Percussion, both superficial and deep, is one of the methods to be employed to assist us in diagnosing altered abdominal conditions. While doing this it is sometimes advisable to turn the patient first on one side and then on the other.

Auscultation is of little value except when there is a doubt between pregnancy, aneurism, or tumour; in other cases it is apt to mislead.

Such are the usual methods by which we determine what is the condition to be dealt with. In rare cases, an aspirator needle may be used to clear up a doubtful diagnosis, but, as this must always be followed by a tapping, the method of removing the fluid will be described in the next chapter.

As regards prognosis we must go wider afield, and study the general condition of the patient, we must examine the state of the heart, lungs, alimentary tract, skin, kidneys, and in doubtful cases, even the nervous system. The following is an interesting example of how disease of the cerebro-spinal nervous system may lead to an erroneous diagnosis. A man with symptoms of locomotor ataxia had a painful tumour in the epigastrium,

which appeared to be connected with the intervertebral discs. This growth had been diagnosed, after an exploratory incision performed in the provinces, as a bony outgrowth from a vertebra, causing pressure on the spinal cord, but it was found after death to be a horse-shoe kidney which had nothing to do with the ataxic condition. It is not sufficient to examine the urine for sugar or albumen, the quantity of urea excreted ought always to be estimated.

For convenience in describing the position of the various organs, the abdomen has been arbitrarily divided into nine spaces by two horizontal and two vertical lines. The upper transverse line is one drawn across the abdomen at the level of the most prominent part of the ninth costal cartilages, and the lower transverse line joins the crests of the ilia as seen from the front. The vertical lines are drawn upwards from the middle of Poupart's ligaments. The nine spaces which are thus mapped out are the right and left hypochondriac with the epigastric between them, immediately below are the right and left lumbar with the umbilical in the centre, and the lower three from right to left, are the right iliac, hypogastric, and left iliac regions.

The consideration of the physical diagnosis of growths of such size that their origin from one or other of those spaces is evident, will now be taken up in detail; the history does not require to be considered in this chapter, and what is ascertained by physical examination will alone be described.

In health the right hypochondriac region contains a large part of the liver, the gall-bladder, a part of the right kidney, the suprarenal capsule, and a small portion of the colon at the junction of the ascending and transverse divisions.

The normal position of the liver in this region is made out by percussion. Almost the whole space is filled by this organ, but it is nowhere to be felt, by reason of its bony covering. In infants it may be felt in the small space unprotected by the costal cartilages.

Growths and enlargements of this organ must therefore be

considered in connection with the epigastric, umbilical, or right lumbar region.

The gall-bladder is situated underneath the liver with its fundus lying below the ninth right costal cartilage, and it lies entirely in the right hypogastric region. When the stomach is distended and the liver pushed to the right, the fundus of the gall-bladder may not be situated behind the ninth costal cartilage but decidedly more to the right. In a natural state the gall-bladder cannot be felt. When it is abnormally distended, the direction in which it increases is that of a line drawn from the site of its fundus to the umbilicus, and it lies against the anterior abdominal wall. When examined between the two hands, the one being in front and the other in the loin, very deep pressure must be made by the latter hand before it pushes the gall-bladder against the hand in front. The shape is oval, somewhat narrow and pointed, or it may be almost globular. The consistency will depend on whether the bladder is filled with fluid or simply with a large number of calculi. When distended with fluid it is usually tense, and, while an indistinct feeling of fluctuation may usually be made out, it sometimes conveys very much the feeling of a solid growth. When distended with calculi, the sensation conveyed to the fingers is that of a solid mass somewhat irregular on the surface, and the movement of the calculi on each other may perhaps be detected. Percussion is difficult on account of the bowel being situated on all sides and behind. Very careful percussion, however, along the edge of the liver, will show that the note is at least less tympanitic in the position of the fissure in which the gall-bladder is situated. There is no pulsation, and auscultation gives a negative result, unless the creaking of the stones on each other can be heard.

The organs which are of interest surgically in the epigastric region are, part of the liver, a portion of the stomach including the œsophageal and pyloric orifices, part of the duodenum, the pancreas, the cœliac axis, and possibly a small part of both kidneys.

The liver lies against the abdominal wall, and its lower margin will be found in the position of a curved line passing from the junction of the eighth rib and costal cartilage on the right side, to the junction of the sixth rib and cartilage on the left side. The position is, however, somewhat variable, and will depend on whether the stomach is dilated or contracted. In a perfectly healthy organ, unless the patient be markedly thin, it is impossible to feel this margin, but it may be mapped out by careful light percussion, and the note becomes much less dull as the edge is approached. The liver may be enlarged as a whole, in the early stages of cirrhosis, when it is waxy, when simply congested, in tuberculosis, in fatty liver, in primary cancer, in abscess, and in hydatid disease, if the two latter be deeply situated. In all these conditions the margin of the liver will be found on percussion to be lower down, and along with this lowered position in the epigastric region, the margin of the organ will also be found projecting below the ribs in the right lumbar region. Posteriorly percussion shows an increased area of dulness. Not only can the margin be made out on percussion, but it can be felt, and the sharp regular edge is most marked when the organ is waxy. In all these enlargements the swelling seems to be situated immediately beneath the abdominal wall. Similar physical signs are obtained when the liver is pushed down by an effusion in the pleural cavity.

When the enlargement is circumscribed, it may be due to cancer, to syphilis, and to abscess or hydatid disease situated near the surface. Palpation and percussion show an irregularity in the margin of the liver more often than any very prominent alteration in shape. In all these diseases a more or less hard irregular nodule or nodules will be felt projecting from the liver. When the enlargement is due to the presence of syphilitic gummata, a depression may be felt in the centre of one or more of the masses; in other respects syphilis and cancer have much in common, and feel harder than an abscess or hydatid swelling. A single cancerous mass may be confounded

with a distension of the gall-bladder, and as regards the physical signs, one must depend on the exact position of the swelling, and on the regularity of outline of the gall-bladder even if it be distended with calculi, in comparison with the more irregular and solid feeling of a malignant outgrowth.

The position of the stomach is a very variable one, and when it is distended, or when there is a tumour in its walls or at the pyloric orifice, it is drawn forwards and very much downwards so that the position of the pylorus, even when moderately enlarged, is usually in the umbilical rather than in the epigastric region. Tumours of the stomach are practically always malignant, they are hard and solid to the touch, usually freely movable, and may be situated, even when of no great size, about the navel or in the right or left lumbar regions. Tumours in this position, like those of the liver, appear to lie close to the abdominal wall, but they are so surrounded by clear sound that percussion is little to be relied on.

Tumours of the pylorus are either malignant or consist of a ring of fibrous tissue. The position in which they are usually discovered is not in the epigastric region, but in the umbilical, slightly to the right of the navel. They also feel near the surface, and appear to be more or less annular, and are hard and solid to the touch. In all cases where malignant disease is suspected, the abdomen must be carefully searched for enlarged glands, or for secondary deposits in any situation. Pyloric growths are too small to allow of percussion giving any information except that it shows that they do not have any connection with the liver.

A foreign body which is known to have been swallowed may be felt through the abdominal wall, and its exact position will depend on the size and shape of the body.

That a stomach is dilated can usually be seen while it is being artificially distended, and its exact dimensions can be readily mapped out by percussion.

Enlargements of the pancreas are due either to malignant

disease, or to the presence of a cyst; it is not probable that a cancerous tumour limited to the pancreas could be felt, still less have its position diagnosed; and by the time a large mass has formed secondary deposits will be found in various directions. As the situation of the gland is so deep, percussion does not give any information.

Cysts of the pancreas are rare, and a small one is not very likely to be discovered. Its position will depend on the part of the gland with which it is connected, and the growth may appear to arise from any of the three upper divisions of the abdomen. In a small cyst situated so deeply it is not possible to make out fluctuation. The growth is more or less rounded, smooth, fixed from behind, and but slightly movable. There is a clear sound in front. When the cyst is situated centrally, aortic pulsation is communicated through the growth, but this will not be of an expansile nature.

An aneurism in the epigastric region will be probably due to a dilatation of the cœliac axis. The position will be fairly median, deeply situated, and the tumour will be found to pulsate. This pulsation differs from that transmitted through a cyst by being of an expansile nature, and, on auscultation, there will be a well marked bruit, and perhaps the heart sounds will be heard.

In the left hypochondriac region are situated the spleen, the remainder of the stomach, the greater part of the left kidney, the left suprarenal capsule, and the tail of the pancreas. The liver and the splenic flexure of the colon may extend into this region.

As the spleen is protected by the ribs, it is impossible to feel it when it is of normal size. On percussion posteriorly, when the patient is sitting, the position of the spleen may be found lying between the ninth and eleventh ribs.

The gland may be pushed downwards by a collection of fluid in the pleural cavity.

Enlargements of the spleen may be due to leucocythæmia,

simple hypertrophy, lymphadenoma, ague cake, waxy disease, inflammation, cysts, and malignant disease. The enlarged spleen appears from underneath the ribs on the left side, feels hard and solid, and when of some size notches may be felt if the enlargements be due to conditions which do not alter its natural shape; but in malignant disease, when a large cyst is present, or when the enlargement is slight, a distinct notch will not be made out. On percussion, a dull or at least a diminished note can be traced from the posterior area of dulness round to the front; but when the growth projects only a few inches below the ribs percussion in front will not give any special information. A small amount of consolidation at the base of the left lung, or a collection of fluid in the pleural cavity, has been mistaken, either for an enlargement of the spleen, or for some thickening in the wall or about the diaphragm, posterior to the spleen. Such a mistake may happen when percussion of the back is relied on without sufficient attention being paid to deep palpation underneath the costal margin, but in any case the diagnosis is difficult. For example, an aspirating needle has been introduced from the back, to remove fluid supposed to be in the pleural cavity, when on *post mortem* examination it was found that the fluid had been withdrawn from a pyæmic abscess at the upper surface of the spleen, and, as the diaphragm had been pushed up, the needle had passed through it.

The right lumbar region contains the lower part of the kidney, part of the ascending colon, and some coils of small intestine.

The right kidney lies deeply in the loin, partly covered by peritoneum, and partly lying against the cellular tissue. Though situated principally in the hypochondriac region, it is more convenient to describe slight enlargements of the organ as if the natural position were in the lumbar region, because an enlarged kidney always sinks downwards. In health it is constantly moving with respiration; the extent of this mobility may be great, and the range of movement is greater in thin than in

stout people. Movable kidney is simply an exaggeration of this normal mobility. In health, except in those who are abnormally fat, the lower end of the kidney can be examined by grasping it between the hands, the one hand being placed flatly on the abdomen outside the rectus, and the other behind, immediately outside the erector spinæ muscle, and below the margin of the ribs. By approximating the hands, and at the same time telling the patient to inspire deeply, a considerable part of the kidney is felt to come between the hands.

The kidney may be enlarged and retain its typical shape in waxy disease, and in the congestion caused by the irritation of a stone. It may also do so in the early stages of strumous disease, and in hydro- and pyo-nephrosis.

In the later stages of these diseases, and also when fluid and solid tumours are found, the distinctive shape is lost. When the kidney enlarges, it inclines at first to bulge out the loin, but its chief direction of increase is downwards and towards the front; it, however, always retains the feeling of fixation in the loin, unless the growth has originated in a floating or misplaced kidney. What is discovered on palpation depends on the character of the enlargement, and it may vary from the sensation of an absolutely solid mass, to that of a thin-walled fluctuating cyst. When the enlargement is small, it can be differentiated from a distension of the gall-bladder by its being posterior. Percussion, in all enlargements of the kidney, is of the very greatest importance owing to the situation of the colon in front. As a kidney enlarges, it tends to come from underneath the ribs, and at the same time it pushes forwards the colon; the clear note given out when this piece of bowel is percussed is invariably discovered running from above downwards, unless the bowel be collapsed, or the tumour be of very great size, in which case the colon may be pushed over to the left side. The gut is not always distended, and when this clear note cannot be elicited in front of a growth which may possibly be renal, very careful examination is to be made to discover

whether a thick band-like substance can be felt in the position of the colon. At one examination this band might be found, and, if at a second a tympanitic track were discovered with disappearance of the band, a diagnosis might almost be made on this one sign alone.

In the umbilical region are, the omentum, the transverse colon, the aorta, a small part of the right kidney, and the larger part of the small intestine. None of these organs can be felt in health with the exception of the aorta; its pulsations are made out because the abdominal wall and the spine are approximated in this situation,—as there is a very short space between the anterior and posterior layers of the peritoneum,—unless the abdomen be distended either by the contents of the intestines or from some pathological condition.

The omentum may be found to be thickened, due to inflammation or to tubercular disease, in which latter case it feels as if it were rolled up into a sausage-shaped mass lying across the abdomen. It may be enlarged from the presence of cysts, hydatid disease, or malignant growths. As the omentum may stretch all over the abdomen, the position of the tumour may not be limited to the umbilical region. Enlargements of the omentum will give the feeling either of solid growths or of tense cysts, and the mobility will be very marked, although scarcely more so than that of a tumour of the stomach. This mobility will serve to differentiate them from enlargements of the pancreas, from retro-peritoneal growths, and in a lesser degree from mesenteric cysts. Percussion will reveal a certain amount of dulness, but this is not likely to be of any diagnostic value.

The transverse colon runs across the upper part of this space, but it may sometimes dip down in a V-shaped manner. A hard mass may occasionally be found, due either to a fæcal accumulation or to malignant disease. It is usually said that a fæcal tumour pits on pressure, though in our experience this is not always the case, even if the patient be anæsthetised. A

fæcal impaction is more often found either in the right or left iliac region, and this is also the case with malignant disease.

Tumours of the small intestine are usually of a sarcomatous nature, and they may be found in any part of the abdomen. They are at first freely movable, and the physical diagnosis gives no information beyond the fact that there is a firm solid growth.

The aorta divides, at a point a little to the left of the middle line and about the level of the umbilicus, into the right and left iliac arteries. An aneurism is not common; it can usually be diagnosed owing to its proximity to the anterior abdominal wall, through which its typical expansile pulsation can be easily felt, and on auscultation a bruit is to be heard.

The left lumbar region contains the descending colon, and some small intestine. Even on deep palpation a normal left kidney does not come between the hands in the way the right one does, because the organ is situated higher up, but in all other respects the physical diagnosis of enlargement of the left kidney does not differ on the two sides.

Malignant disease of the colon is rather more common at the splenic flexure than in the transverse division, and is the gravest condition which may possibly be mistaken for a slight enlargement of the spleen.

In the right iliac region are the cæcum with the appendix, part of the ascending colon, and these cannot be felt in health. The swellings which are met with in this situation are, malignant tumours of the cæcum, impaction of fæces, inflammatory distension of the appendix, and the various sequelæ of an inflammation of this blind tube.

Malignant disease and fæcal impaction in the cæcum have various physical points in common. The tumours are hard, with a slightly roughened surface, and are not absolutely fixed. The fæcal impaction, as has already been mentioned, pits on pressure when not of too long standing, although this may not

be evident unless the patient be anæsthetised. When the appendix is dilated and can be felt, its usual position is about the junction of the right iliac and hypogastric regions, and its position is by no means a fixed one, and it may also be discovered in the umbilical, or possibly in the right lumbar region. Its shape is that of a cylindrical body of the length and thickness of a forefinger, tender to anything but the very gentlest manipulation, and the most sensitive part is a spot on the skin known as M'Burney's point. This is situated midway between the umbilicus and the anterior superior spine of the ilium, and marks the usual position of the junction of the appendix with the cæcum. When inflammation of the appendix has led to the formation of an abscess, a tumour usually of an indefinite character is found, and its exact position will vary with the situation of the appendix itself. The feeling of resistance will be marked on comparing the one side with the other, and an examination conducted either through the vagina or the rectum may reach the swelling from below, but bimanually it will be rendered difficult by the tenderness and rigidity of the abdominal muscles.

The hypogastric region contains some of the small intestine, the bladder when distended, the uterus when enlarged, the ovaries when the seat of a growth, the Fallopian tubes when greatly distended either by a fœtus or simply by fluid, and a pelvic abscess may be found pointing in the outer part of this region or in either of the lateral ones.

Temporary distension of the bladder may be caused by any obstruction to the outflow of the urine, and as a secondary result of this, a somewhat chronic condition of atony of the walls due to over-distension may result. Rising immediately above the pubes a globular fluctuating tumour is felt, in close connection with the abdominal wall, and with a very slight amount of mobility. The cyst gives the feeling that it is thin-walled, and is so tense that fluctuation may not be at first apparent. It may be mistaken for pregnancy, for an ovarian

tumour, or, when very much distended, for a retro-peritoneal cyst. Whenever a swelling may possibly be a distended bladder, a catheter must be passed, and it is well not to take any one's word that this has been done. In the rather rare case when an ovarian tumour is central, it resembles a distended bladder in a very marked way. This was very well seen in a patient who was sent into the Edinburgh Royal Infirmary with a tense cyst absolutely central, which extended about four or five inches above the pubes, and came low down into the pelvis in front of the uterus. In appearance and on examination it resembled distension of the bladder so very closely that a catheter was passed, without result, whereupon the patient remarked that her own doctor had already done that twice. In another case seen in the country, where a peculiar abdominal tumour had been discovered in a man, both the doctor and a consultant were puzzled to make out the nature of the cyst, and both had passed a catheter but no water had come away. Acting on the principle which has been laid down, a catheter was passed a third time, when fortunately it was made to enter the bladder and the cyst very quickly disappeared.

An enlargement of the uterus in this region will be diagnosed by its central position, by the soft indefinite outline if due to pregnancy, and by its solid and more defined condition if due to a fibroid tumour or to retention of the menses. On bimanual examination the continuity of the abdominal tumour with the cervix will be made out in a pregnancy at this stage of advancement, and also when the growth is due to the presence of a fibroid tumour. When the swelling has been caused by an obstruction in the vagina the internal examination will lead to the recognition of the condition.

An ovarian tumour which does not reach beyond the hypogastric region is almost invariably situated more or less to one or other side. Bimanual examination shows at once that the tumour is unconnected with the uterus, unless the broad ligaments be extensively opened up, in which case the uterus will

be felt to be closely connected to one margin of the tumour, but its shape can be distinctly made out.

Distension of a Fallopian tube, when large enough to be felt on abdominal palpation, is found not to be central, and to be of a peculiar irregular shape. Bimanually a connection will be found between this tumour and one side of the uterus, or with both, if both tubes be distended.

Pus may be found pointing above Poupart's ligament in this or in either of the two iliac regions. A fluctuating tumour is felt closely connected with the pelvic wall, and on rectal or vaginal examination this swelling may be traced down into the pelvis.

The left iliac region contains the sigmoid flexure of the colon, part of the descending colon, and some coils of small intestine.

In the sigmoid flexure cancerous tumours, fibroid thickenings, and accumulations of fæces are found. Nothing more need be said about such swellings than has already been said about similar enlargements in the cæcum.

The condition known as intussusception, that is to say, a doubling in of the bowel into itself, may be found in any of the regions below the upper transverse line. What may be felt is an elongated sausage-shaped tumour, usually curved and of variable length. It is tender to the touch, and is more common on the left side of the abdomen. The diagnosis of this condition is made rather by a consideration of the symptoms than by the physical examination.

Retro-peritoneal and mesenteric cysts may be found in any part of the abdomen, and when small the physical diagnosis might be made by exclusion, the swelling being evidently not connected with any organ.

So far the consideration of the physical signs of small tumours has alone been taken up. It will now be necessary to give generally the physical signs presented by enlargements entirely, or almost entirely, filling the abdominal cavity, and

where no indication is therefore given with what organ the growth is connected.

Such large growths are most commonly divided into cystic and into solid tumours, and along with the former will be included those where fluctuation can be made out at one or more points. Cystic growths of this size are rarely seen in connection with the liver and gall-bladder, as rarely with the spleen, occasionally with the pancreas, in hydatid disease of various organs, in the mesentery and the retro-peritoneal tissue, decidedly more frequently with the kidney, and most commonly with the ovary. The natural enlargement of the uterus, and the condition of hydramnios, have always to be considered when the question of diagnosis comes up, and these with fibro-cystic tumours of the uterus, complete the list of large cystic growths. Another condition causing great distension of the abdomen is the presence of ascitic fluid, sometimes encysted, although it is rare to find a large collection enclosed within an adventitious sac.

Cysts in the upper part of the abdomen cause a decided raising of the chest wall, and an indication will be given from which side the growth has arisen by the relative amount of this on the two sides. They also, and more especially when in actual contact with the diaphragm, move downwards on deep inspiration, and in this way differ from growths arising from below, for in them the downward descent caused by inspiration either raises up the wall from off the tumour, or pushes down intestine in front of it, unless there be intimate parietal connections in the upper part of the abdomen. Even in such cases the mass is not pushed down. The wave which can be felt in all large collections of fluid in the abdomen, unless perhaps the wall be enormously thick and tense, is the impulse which is given to the hand placed on one side of the abdomen when a slight blow is given to the other side. When fluctuation is thus obtained the diagnosis of fluid is made very easily. Difficulty arises in the case of small cystic growths, and when a tumour is

partly solid and partly cystic. In these cases fluctuation as described is not obtained, but there is what may be called a "feeling of fluid." The two hands are placed firmly on the abdomen, and an impulse is conveyed to the one while the other remains firmly applied to the surface. With practice the difference between a solid growth, a cyst, a cyst with tense thick walls, and a soft solid with an elastic feeling, can be differentiated in this way. When there is a tumour in the upper part of the abdomen a dull note will be got above the growth, and it will not vary on deep inspiration, as intestine is not present to come between the wall and the tumour.

A renal cyst will be found to bulge more in one loin than in the other, and may not enter into the loin on the other side. Palpation and percussion may show the position of the colon running from above downwards and decidedly on the inner side of the swelling. With cysts in this position, and more markedly in those growing from below, deep inspiration will tend not so much to move the tumour but to move the abdominal wall over the growth, and on percussing along the upper border during expiration a dull note will be elicited, which is altered into a tympanitic one when the patient inspires deeply. In tumours without any pelvic connection it is usual to find a clear note of more or less depth running across the abdomen below the cysts, while the reverse is the case when the growth has sprung from the pelvis.

Ascitic fluid is differentiated from a cyst by the great difficulty in respiration in comparison to the size of the swelling and by the percussion note, which is more fully referred to in the fifth chapter.

Solid tumours of the abdomen do not differ, except in their feeling of consistency, from cystic growths. Their position may be the same, they may grow to as great a size, and they may resemble a cystic tumour, except in the want of fluctuation.

Whenever an abdominal tumour could possibly be a pregnancy, auscultation must be most carefully made. Even in

very large cystic tumours this may be necessary, from the possibility of an abnormally large amount of amniotic fluid, or from the presence of a cystic growth in addition to the pregnancy.

Very rarely the abdomen may be distended by a large collection of fæces, the accumulation being distributed generally over the whole of the abdomen. This condition may present the appearance of a distinct abdominal tumour, and it is diagnosed either by feeling that the mass at one or more points pits on pressure, or by careful percussion, when it will be found that the note, if not absolutely tympanitic in the centre of the abdomen, is decidedly less dull. Rectal examination may give no information, as the bowel may be either loaded or empty. When treating such a case it is advisable not to attempt the removal of the accumulation too suddenly, as alarming or even fatal collapse has resulted from too energetic treatment.

Phantom Tumour.

A distension of the intestine by gas gives rise to a condition known by the name of phantom tumour. It is almost entirely confined to women, and is usually seen in those who are hysterical, or in others about the time of the menopause. The patient does not seem to be able to diminish the distension voluntarily. On inspecting the abdomen, the appearance may resemble what is seen when an ovarian tumour composed of one or several cysts is present, and even on placing the hands on the abdomen one might be mistaken as to the nature of the swelling until it is percussed. As soon as this is done there can be no excuse for an error being made. To convince the friends of the nature of the enlargement, it may be necessary to administer an anæsthetic and let them see how flat the abdomen becomes as soon as the patient is unconscious.

CHAPTER II.

TAPPING, ASPIRATION, AND EXPLORATORY INCISION.

After the ordinary measures of making an examination have been exhausted without a diagnosis having been arrived at, we may adopt one of the two following means to clear up the condition which exists inside the abdomen. These two aids to diagnosis are tapping or aspiration, and an incision through the abdominal wall for the purpose of exploration.

Tapping.

Tapping or paracentesis abdominis was at one time the only way of treating collections of fluid inside the abdomen. It was performed in a rough and ready manner: the patient was seated on a chair or on the edge of the bed, a bucket was put between the legs, and a short thick trocar and cannula was thrust through the abdominal wall. It would hardly be expected that any form of treatment carried out in such a way would survive when other methods could be chosen. It was a dangerous way of tapping; a large quantity of warm fluid was withdrawn from the body, and little or no precautions were adopted to keep the patient warm; with the not infrequent result that the patient caught a chill, and this was followed by an attack of acute peritonitis. This method of

performing a slight operation has been entirely abandoned, and we have now the choice of two ways of removing abdominal fluid by simple puncture. The one resembles the old method to a certain extent, and the other consists in the removal of the fluid by suction ; the first is tapping, the second aspiration. Tapping is to be employed only for the removal of ascitic or free fluid from the abdominal cavity; and aspiration must invariably be the plan adopted when the fluid from an encysted cavity is being withdrawn.

The instruments required for a tapping are very simple; they consist of a trocar and cannula one-twelfth of an inch in diameter ; to the cannula an india-rubber tube can be attached ; or, if Wells' blunt tapping cannula is to be used, we will require in addition to be provided with a bistoury.

The patient is to be in bed, lying on his side close to the edge, with a hot water bottle at the feet, and the height of the head is to be as the patient finds comfortable, but not too high. A towel is tucked in below the abdomen, and the spot in the middle line where the trocar is to be inserted is washed with some antiseptic solution. The exact site of the puncture should be wherever it is most convenient and least painful; and this will be usually through the umbilicus. After having ascertained by percussion that the intestine is not lying against the seat of puncture, the trocar is pushed through the abdominal wall. The point of the instrument should be sharp, so as to penetrate the peritoneum, and not simply push that membrane away in front of it. The trocar is withdrawn, and the end of the rubber tube at once slipped on to the cannula, the small quantity of fluid which escapes falling on the towel. The other end of the rubber tube lies in a basin on the floor, and the fluid is allowed to run until the peritoneal cavity has been emptied. As it comes near to an end the patient is rolled round gently on to the face, so that the opening will be the most dependent part of the abdomen. As soon as the fluid ceases to flow, the tube is closed with the finger and thumb, or the end is kept carefully

in the fluid in the basin, and the patient turned round again on

Fig. 1.—Wells' Tapping Trocar and Cannula. (Full size.)

Fig. 2.—Keith's Tapping Trocar and Cannula. (Full size.)

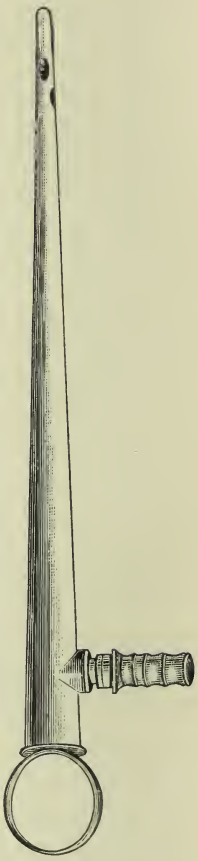

Fig. 3.—Wells' Cannula for Ascites. (One-half size.)

to the back. As the cannula is withdrawn, the surrounding skin is pinched up between the finger and thumb; and, should

there be any bleeding from the opening, a little time will be given for it to cease before a piece of sticking-plaster, two inches square, is put on. Should the bleeding not tend to stop, the wall may be transfixed with a needle and pressure made by twisting a thread round it. A broad flannel bandage may be put on to make the patient comfortable, and if the abdomen be very flat, the hollow is filled up with wadding. The after treatment consists in keeping the patient on the back, so that the puncture opening will be at the highest level; and fluid which may remain behind has thus no tendency to escape. Perspiration must be encouraged, partly to promote absorption of any fluid which may be remaining, and partly to bring the blood to the surface, and thus prevent stagnation in the abdominal blood vessels. The patient is kept in bed for two or three days, after which he can get up as usual.

When Wells' blunt trocar is used, a very small incision is made with a bistoury into the peritoneal cavity; and, if a thin-bladed knife be used, the patient hardly feels the pain of the little cut, which is not more than a quarter of an inch in length. The bistoury is withdrawn, the cannula is inserted into the opening; and, as the instrument, narrow at the point, and rapidly increasing in size, is provided with several holes, fluid runs away rapidly. A gallon or two can be emptied with this instrument in a very few minutes. The after treatment is exactly the same as when the trocar is used, and the little wound heals as easily. This method is only to be used when the abdominal wall is thin, or when the opening is made through the umbilicus. When this slight operation is performed in the way described, and with a clean instrument, there is absolutely no danger. Instead of removing the fluid in a few minutes, a fine trocar with capillary tube is sometimes used to empty the abdomen slowly. There is not any advantage to be gained by adopting this plan in preference to the one already described, because the rapid method leaves nothing to be desired when properly carried out. The disadvantages of

leaving a patient for many hours with a trocar in the peritoneal cavity are, that the patient has to lie very quietly or run the risk of the trocar slipping out, and there is a certain amount of danger of erysipelas resulting from the prolonged irritation.

Aspiration.

For aspiration, the most convenient instruments consist of what may be called an exploring instrument; and a second with which large quantities of fluid can be removed; the

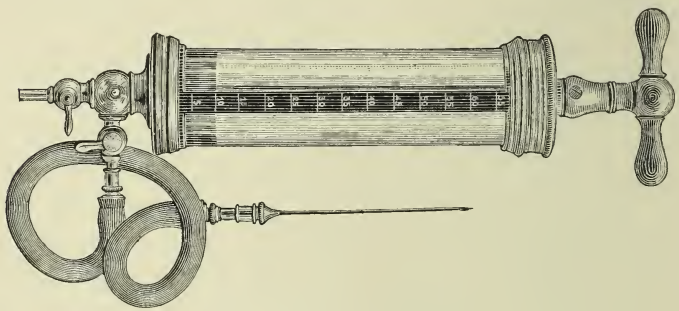

Fig. 4.—Dieulafoy's Aspirator.

principles of both being exactly the same. The first of these instruments is that of Dieulafoy; it consists of an exhausting cylinder, which can contain fully two ounces, and is provided with two stop-cocks at one end.

Before the air is exhausted by withdrawing the piston, both stop-cocks are closed; to one is attached a piece of rubber tube with thick walls to the other end of which a hollow sharp-pointed needle is fitted. It is to be used when there is a doubt as to whether a growth contains fluid or not: the syringe is exhausted, the needle is rendered aseptic, and is plunged into the most likely part of the swelling. The stop-cock connected with the needle is opened, whereupon fluid, if present in the tumour, flows into the cylinder; should the amount of fluid be evidently small, this stop-cock is closed when the cylinder is full, and the

fluid it contains is driven out by pushing down the piston, after the other stop-cock has been opened. To refill the syringe both stop-cocks are closed, and the air is exhausted.

When fluid is evidently present, and the quantity great, a large and more powerful apparatus will be required. This consists of an air-pump fourteen inches long and one and a half inch in diameter, connected by a very thick-walled rubber tube to a rubber cork inserted in a Winchester quart bottle. Through this rubber cork pass two metal tubes, guarded by stop-cocks. One of these is connected with the air-pump, the other to a thick-walled rubber tube, to which the cannula will be attached. The trocar and cannula to be used is the same as that previously mentioned when describing tapping. The patient is to be in the same position as during tapping; the trocar is inserted into the encysted fluid, and as it is withdrawn, leaving the cannula behind, the tube is immediately put on to the cannula; and, the stop-cocks being both open, the nurse, or whoever is present in the room, steadily works the air-pump so as to keep a constant vacuum in the bottle. When the bottle is filled the contents are to be emptied out, the stop-cock in connection with the cannula being closed; as soon as the bottle is emptied the cork is introduced, the stop-cock is opened, and the nurse recommences pumping as before.

When the sac is nearly empty, exhaustion of the air in the bottle must not be very great, simply enough to keep the fluid running, otherwise the lining of the cyst is likely to be sucked into the cannula, and may be injured, or at least may stop the outflow. We must never be satisfied until the cyst has been thoroughly emptied; and we must never, under any possible circumstances, leave unemptied a collection of fluid through the capsule of which an opening has been made. Nothing can be more dangerous than the not uncommon practice of withdrawing a small quantity of fluid, say a hypodermic syringeful, from a cyst. If the cyst wall be very thick, there may not be any oozing from the puncture opening; but there is almost certain

to be a rupture, starting from the puncture, and, if the contents be malignant, the infection of the peritoneum is certain to follow. When aspiration is performed in the way described—never using a larger needle, though it may be sometimes smaller, and emptying completely any sac that has been punctured—there is no risk, either of extravasation of fluids or of infection of the abdominal cavity. Should a small quantity of fluid be accidentally left behind, the position of the patient, with the opening at the highest level, would prevent any escape.

Aspiration has gone very much out of fashion, partly because the operation was badly performed, much too large a trocar being used; and partly because abdominal operations have come into fashion, for undoubtedly fashion plays a part in surgical matters; and the misery, which even a simple incision of the abdomen gives to the patient and to all the immediate friends, is very much ignored. Also, when a diagnosis has not been made, it is very easy to say that it cannot be made, but that an exploratory opening will clear up all doubt; and, at the worst, will do no harm. Tapping is often said to be dangerous; but it is only so when it is badly performed, and the great argument against it seems to be the fear that malignant disease may be spread from the interior of a cyst to the general peritoneal cavity. A very good example of how this opinion, for it is only an opinion, is supported, is shown by the following notes of an operation at which we assisted a number of years ago. A diagnosis of ovarian tumour had been made, in the hospital to which the patient had been sent, after the abdomen had been tapped several times. When the peritoneum was opened a large quantity of ascitic fluid flowed away; and, on looking into the cavity, the pelvis was seen to be filled by a papillomatous and apparently solid tumour. There was no appearance of a cyst wall anywhere, the hand could not be passed into the pelvis to make a more thorough examination, and the incision was closed. Some time afterwards this case was reported as showing the disastrous effects which may follow the tapping of a malignant

ovarian tumour, although there was no direct evidence that an ovarian tumour had been tapped, nor that the fluid which had been drawn off had ever been anything but ascitic fluid; and the evidence seen at the time of operation appeared to us to show that ascitic fluid had alone been withdrawn.

The reasons why aspiration is not to be used when there is free fluid in the abdominal cavity are, that suction is not necessary, and that the fluid flows away more easily without it, as omentum or bowel is not so likely to become engaged in the opening of the trocar. An encysted fluid must never be tapped, it must always be aspirated, because it is essential that the whole of it be removed; and besides, it may be so thick that it will not run through a cannula without the aid of suction.

Tapping is used to remove fluid when there is any obstruction to the circulation resulting in the pouring out of ascitic fluid into the peritoneal cavity. Ascitic fluid, caused by the presence of tubercular disease, or of malignant growths on the peritoneum, or on the surface of an abdominal organ, can also be removed in this way. To clear up a diagnosis it may be necessary to examine the fluid microscopically. The way to do this is to allow the last basinful which has been drawn off to stand for some hours protected from dust; and to examine the deposit which remains after the top of the fluid has been poured off, or to take what has been sticking to the surface of the basin.

Aspiration, as distinct from tapping, may be employed for the purpose of clearing up a diagnosis, or to remove fluid from a cyst in a patient in a very much debilitated state of health, thus giving time for some general improvement before any severe operation is performed. In pregnancy also, especially during the later months, a cyst may be aspirated rather than removed, so as to carry on the patient until the child is born, without running the risk of inducing premature labour, which commonly follows the operation of ovariotomy when performed at such a time. Broad ligament cysts may be cured in a certain

proportion of cases by removing the fluid; and in exceptional cases an ovarian tumour does not refill after being emptied; but such cases are so rare, that they may be looked upon rather as curiosities than as of any practical importance in the treatment of such tumours. By removing fluid from a hydatid cyst a complete and permanent cure may sometimes be obtained.

Tapping and aspiration must be invariably carried out through the abdominal wall, never by the vagina or rectum; the risk of hæmorrhage from the puncture wound is much greater when the fluid is attacked from below; and it is almost certain that, when this is done, a leak will result; malignant disease, if present, will be spread; or an attack of inflammation accompanied by the formation of adhesions may be lit up.

Fluids removed from the abdomen vary in appearance and in consistency. They may be colourless like pure water, or they may vary from that to bright red, or to almost black; they may be perfectly fluid, or as stiff as a thick jelly, or almost as solid as putty. A positive diagnosis cannot be made from the appearance and chemical examination of any of those fluids; a certain amount of assistance may certainly be obtained, and this will be gone into more fully when the consideration of each special disease is taken up.

With the microscope a positive diagnosis can be made in two diseases. In the case of hydatids the finding of even a single hooklet is pathognomonic. In malignant disease, it is possible to say that the fluid has been thrown off from a malignant growth; but whether the disease is situated in the interior of a cyst or on the peritoneum must be diagnosed by other means. In a fluid thrown off by a malignant tumour blood will always be found; at first sight this may not be evident; but, after standing for twelve hours, it will be seen to be deposited on the bottom and sides of the basin. The blood is thoroughly mixed with the fluid, and the appearance is quite different from what is seen when the trocar injures a small vessel. If a small quantity of this deposit be examined under the microscope, large

cells containing one or more nuclei as large or larger than a red blood corpuscle may be seen. Of these there are two varieties; the one where the outline of the cell is regular, the other where out-growths are forming, and proliferation is rapidly going on. In the latter the disease is much more acutely malignant.

Dr. Foulis of Edinburgh drew attention to these cells, some

Fig. 5.—Foulis' Cells.

fifteen or twenty years ago; the drawings are taken from the original papers; and they represent exactly what we have frequently seen on microscopic examination.

The advantage of being able to make a diagnosis in this way is, that it is the only method by which we can apply sound surgical treatment to malignant tumours of the abdomen. If these cells be found in fluid which has been withdrawn from the interior of a cyst, the sooner the cyst is removed the better; the

whole organ in which the malignant disease is situated will be taken away, and we may expect that the patient will be free from any return for a number of years, or may be completely cured. On the other hand, if we find the very wildly sprouting cells in a fluid which has been removed from the peritoneal cavity, and more especially if any nodules can be felt, no matter how small, either on abdominal or pelvic examination, it will be unnecessary to advise the patient to undergo an abdominal operation, because we believe that in those cases life cannot be prolonged by any such operation, as the whole of the disease cannot be removed. In a third class, in a free peritoneal fluid, which has apparently come from the rupture of a removable tumour, we may find cells which are not proliferating, but which contain large nuclei. If there be a trace of blood in the fluid, the probability is that the tumour is malignant, but the malignancy need not be of a very active nature. When no nodules are felt removal of the tumour ought certainly to be advised; but the friends may be warned that the disease is certain to recur sooner or later, usually in about one year, the patient being in the meantime in a good state of health.

It is certainly very difficult to know where to draw the line about operation; but there is no doubt that there are some cases where the patient has nothing to gain by an abdominal section, and where as correct a diagnosis can be made by the help of the tapping trocar as by an exploratory operation. In the doubtful cases, tapping may be followed by operation; and this is the proper line of treatment to pursue; for the peritoneum does not of necessity become affected immediately after a rupture has taken place, and a patient may live for some years in perfect health, as happened in the following case. A lady, thirty-six years of age, was seen in the early spring of 1890; for about two years she had known of the presence of an abdominal tumour, which had been frequently diagnosed to be a uterine fibroid, although there was a most evident history of rupture followed by five separate attacks of acute peritonitis. The tumour was evidently

an ovarian one, closely connected to the uterus, and the patient was advised to have it removed, but she and her husband could not make up their minds. In the end of March, the cyst gave way for the sixth time; and, as soon as she had recovered from a sharp attack of peritonitis, she consented to have the tumour removed. This was done in May of the same year. The adhesions in the pelvis were extensive and extremely firm; there was some free fluid in the peritoneum; there was a large rupture in the cyst, and in its interior a quantity of papillomatous masses were seen; but no deposit was noticed on any part of the peritoneum. Out of curiosity the fluid was examined microscopically; cells with large nuclei were seen in abundance, and one or two doubtfully sprouting masses. The patient remained in perfect health until the beginning of November 1893, when she complained of indefinite abdominal symptoms; but no return of the growth could be felt on abdominal or vaginal examination. By the end of the same month a mass could be easily made out on the right side of the pelvis, and a second one on the abdominal wall a little to the left of the scar.

Exploratory Incision.

As an alternative to removing fluid from the abdomen for the purposes of examination, an operation has been performed with great frequency in the last ten or twelve years; it is called exploratory incision, or laparotomy. The object of this operation is twofold: it may be used either when a diagnosis has not been arrived at, or when a diagnosis has been made, but where it is uncertain if the growth can be removed.

Performed for either of those two reasons the operation has a distinct position in surgery; it may be that, in exceptional circumstances, it is impossible to say what is the nature of the growth inside the abdomen; and it may also happen that one cannot be sure whether a growth can be removed or not. Still there is probably no operation which has been more thoroughly

abused, and the recklessness with which it has been taught that the abdomen is to be opened, apparently whenever a growth has been discovered, without exhausting all possible methods of making a correct diagnosis, is without parallel in the history of surgery. As many as 10 per cent. of all abdominal operations have been reported as the number of exploratory incisions made by at least one operator; that is to say, that out of one hundred operations one in ten was found to be unnecessary. If we add the number begun as exploratory incisions, and afterwards placed among the lists under various headings, we get some idea of what can only be called the reckless disregard, if not for the life, at least for the comfort of the patients and of the whole circle of friends. The patient places himself in our hands, and it is not right to expose him to the risk, slight though it be, which accompanies an exploratory incision; nor are we justified in allowing him to run the risk of the future misery which follows a ventral hernia, although this risk ought also to be a very small one; nor are we entitled to perform an operation entailing a great deal of expense, and which will confine the patient to bed for at least a couple of weeks, simply to save ourselves some trouble. It must doubtless always be, even when every care is taken, that some surgeons will perform more exploratory operations than others; but this will not justify any one in not availing himself of every possible means which will assist in making a diagnosis, and thus prevent a certain number of unnecessary operations. As an example of an unnecessary case of exploratory incision, the following case which occurred in the practice of a provincial surgeon may be cited. The patient was seen by this operator, some months after the diagnosis of malignant disease had been made, and the opinion expressed that a successful operation was not possible. An exploratory incision, which simply confirmed the previous diagnosis, was made, and the patient of course did not receive any benefit.

A second case gives an example of an exploratory operation

performed after a diagnosis had been made, but where there was a doubt as to whether or not the tumour could be removed. A man, fifty years of age, was seen in consultation, who gave the following history. Fifteen months before, he began to suffer from severe pain in the abdomen, and a hard tumour was discovered in the epigastrium. For some months before this there had been a considerable amount of dyspepsia. During the following fifteen months more than forty physicians and surgeons were consulted, and various opinions were expressed as to the nature of the growth. As a rule, the patient was allowed to choose between two, three, or four different maladies. At length he consulted a well-known physician, being desirous to be told exactly what was the matter. Examination revealed a hard tumour with a regular outline, extremely movable, and situated in the upper part of the abdomen. The growth measured about five inches in breadth and three to four in depth and thickness. The diagnosis arrived at was that of a malignant tumour in the upper part of the omentum; and, as it seemed so very movable, an operation was advised, exploratory in the first instance, to be followed by the removal of the tumour if that were possible. The incision having been made, the tumour was found to be situated, not exactly as had been anticipated in the omentum, but intimately connected with the greater curvature and posterior wall of the stomach; situated in this position the completion of the operation was not possible, but the patient expressed himself satisfied, as all doubt about the case had now been set at rest.

This case represents an extreme example of the difficulty which patients experience in obtaining a positive opinion, and while we do not mean to say that such an opinion can invariably be given about every case, still it is not fair to tell a patient that he or she is suffering from one of several diseases; it would be far better to say, "I am unable to tell," and to recommend one or two other opinions — the best that can be got — and then, even if a diagnosis had still not been

made, an operation need not be performed unless the case be urgent.

The words of Richard Wiseman may well be remembered. "Thou wilt also learn one necessary piece of Humility—viz. not to trust too much to thy own judgment, especially in difficult cases, but to think fit to seek the advice of other Physicians and Chirurgeons whose long experience hath enabled them to assist thee in preventing the accidents, and encourage thee to go on in the work or forewarn thee of the danger. After thou hast thus defended thyself from the censure of rashness, proceed boldly, and let thy sincerity in thy acting be thy warrant for God's blessing on thy endeavour."

It is not fair to give a patient what is nothing more than an extract from a text-book, and allow him to make the choice of the disease. We came across an amusing example of this not very long ago, where the following diagnosis was given to the friends. "The case may be one of extra-uterine pregnancy, a pyo-salpinx, a hæmatocele, an ovarian tumour, or a fibroid tumour of the uterus," and strangely enough the sequel showed that it was none of them!

As an example of what has been said of the advisability of taking two or three opinions, and then, when there is no urgency, waiting for time to clear up the diagnosis, the following case may be mentioned.

A lady, fifty-two years of age, who had ceased menstruating, began to suffer from pains, and discomfort in the pelvis. Her doctor sent her to a consultant, who made a diagnosis of ovarian tumour, and advised immediate operation. Not satisfied with this opinion, he sent her on to a second; on this occasion the diagnosis was made of an old uterine fibroid which did not require any operative treatment. With this opinion the doctor was satisfied, but the friends were not; and, for the third time within two weeks, another consultation was arranged. Again a different diagnosis was given, the opinion being that the tumour was an old fibroid, but that there were, in addition, several

nodules on the peritoneal lining of the pelvis, and that a small amount of ascitic fluid was also present. No treatment was advised, and time proved the last diagnosis to be correct. Surely this was better for the patient and her friends, than rushing into the operation, which time showed to be totally unnecessary.

CHAPTER III.

THE PREPARATIONS FOR AN ABDOMINAL OPERATION AND THE OPERATION.

The thought of an operation is always formidable to a patient. All means must therefore be taken to disturb or alter the usual way of life as little as possible consistent with a due regard to safety. Where the patient, especially if a woman, has a comfortable and well-drained home, let her be operated on in her own room and with her accustomed surroundings. In an ordinary well-kept bedroom it is quite unnecessary to take up carpets, remove curtains and furniture, and so make the room look uncomfortable and unfamiliar.

The choice of the nurse is of great importance, she has a great deal in her hands, and the life of the patient often depends on her watchfulness and care. She must be endowed with the faculty of observation, she must be absolutely truthful, and must follow her instructions to the letter. It is necessary that she be mentally strong, so as to be able to keep a firm control over the patient. At the same time she must be kind, gentle, a light sleeper, and able to take entire charge for the first few days after an operation. Of course she must be able to pass a female catheter, and to give an enema. Such a nurse is a rare and valuable woman.

It is not necessary for her to be at the patient's house the day before the operation; in a couple of hours everything can be got ready. She must make no preparations in sight of the

patient; all that she requires to attend to is to have at hand a couple of wash-hand basins, a flat dish for the instruments, a bath, several hot water bottles, plenty of hot and cold water, some towels—a dozen will be more than sufficient—half-a-dozen large pins, a flannel bandage,—one yard and a quarter torn down the middle will make two bandages—and some brandy or whiskey. She must also arrange to have her bed ready to put into the room immediately after the operation. A most convenient bed for this purpose is that known as the hammock bedstead.

The nurse must not attempt to sit up during the whole night with the patient. If she do so she will quickly break down, and many patients do not sleep well when they are watched.

Preparation of the Patient.

The general health having been attended to if necessary, the special preparations are simple; a dose of castor-oil, large enough to move the bowels well at least twice, is to be taken two nights before the day of the operation; an injection is to be given on the morning of the day only if the bowels have not moved well. The food, after this dose, is to be light, such as tea, soup, pudding, etc.; much milk being avoided. It is almost necessary to explain to the patient what light food means, so as to avoid the danger of an attack of obstruction from fæcal impaction, which an old lady went through, from taking the following amount of food after the bowels had been well moved,—an egg for breakfast; soup, fish, roast-beef with Yorkshire pudding, etc., for mid-day dinner; an egg with her tea; a large piece of yellow cheese, bread, and milk, for supper; and another egg for breakfast on the operation day; and all to keep up her strength!

The patient goes to bed half an hour or so before the arrival of the surgeon. The clothing is to consist of a flannel or silk under vest, if the weather be cold or the patient accustomed to wear one, an ordinary night dress, a flannel dressing jacket, a

flannel petticoat, not fastened at the waist; and stockings. If the patient be a man, he must wear a flannel vest and drawers, stockings, and night shirt. The nurse washes the abdomen thoroughly, first with soap and water, and then with a 1-1000 solution of bichloride of mercury. The patient gets up to pass water after the surgeon is in the house, unless it be desired to have the bladder somewhat distended. A catheter is on no account to be used, it is simply teaching a bad habit.

For the sake of the patient, punctuality on the part of the surgeon and his assistants is very necessary.

Instruments and Appliances.

Everything required for the operation must be ordered or brought by the surgeon himself; he must see after everything; there must be no divided responsibility. He will have had sent in from the chemist:

Ether	1 lb.
Carbolic acid	℥iii.
Solution of carbolic acid in glycerine (1-8) .	℥iv.
Solution of tartarate of morphia (1 gr. in 12 minims)	℥i.
Saturated solution of perchloride of iron in glycerine	℥ii.

Six yards corrosive gauze.

Corrosive sublimate tabloids.

Two sheets of ordinary cotton wadding.

For an ordinary abdominal section, the following list of instruments and appliances is to be taken by the surgeon. This list does not include instruments for special operations, as these will be mentioned when diseases of the different organs are taken up in detail.

A portable table, 18 inches broad, 6 feet long, and 40 inches in height.

A belt for fastening the legs.

Bandages for fixing the hands.

An india-rubber sheet, 3½ feet broad, 2½ feet long, with an oval opening in the centre, 8 inches by 4 inches, the edge of which has been smeared on the wrong side, 1½ inch in width, with some of the following plaster :—

℞ Ol. olivæ opt. . . . . ℥vi.
Emplast. resinæ . . . . . ℥iii.
Emplast. saponis . . . . . ℥iv.
———Misce.

Sig.—Melt and apply as directed.

An india-rubber sheet of the same size without the opening, to cover the legs.

A number of the finest Turkey sponges varying from half-a-dozen to thirty. They must be of different shapes and sizes ; a medium one will be about the size of the closed fist ; some for sponging out the pelvis through a small wound will be smaller. The ordinary flat sponge, unless it be unusually thick, is of more trouble than service, for, when thin, the intestine simply pushes it aside. A few sponges large enough to hold a pint of fluid are of great use when there is much fluid in the peritoneum. Before being first used they must be thoroughly purified. There are various ways of doing this, but as satisfactory a method as any is the following : the sponges are thoroughly beaten, so as to get rid of as much sand as possible, and are then to be left for four or five hours in hydrochloric acid, one drachm to the pint. Next they are to be washed many times in hot water, and finally they are placed in a 1-40 solution of the best phenol, and are kept there until they are required for use. Before the operation a number, depending on the severity of the case, are wrung out of the carbolic solution, and placed in a thoroughly purified double tin, the outer casing of which is filled with hot water at the patient's house. It is more than desirable to have the sponges handled by no one

except the surgeon and his assistant, and a sufficient number ought always to be taken, to avoid the necessity of their being washed during the operation. As the surgeon ought always to see to the cleansing of the sponges after an operation, it is not right to depute this duty to a nurse during its performance. The sponges must be counted before the operation, and it is advisable to mark down the number, so that there may not be any doubt when they are counted before the abdomen is closed. No sponge must be torn, and under no circumstances must one be used which has fallen on the floor, or come in contact with pus or any fluid which may cause irritation. Before they are again used, they must be placed in a solution of carbonate of soda, one handful to every ten sponges in a gallon of water. After removing most of the blood in this solution, they are to be put into a second soda solution of the same strength, and left there for several hours, being stirred up occasionally. At the end of this time they get a tremendous washing at the warm water tap, and are put back into the carbolic acid solution. A good sponge treated in this way will last out many years of hard work. If it be desired to whiten the sponges, they are

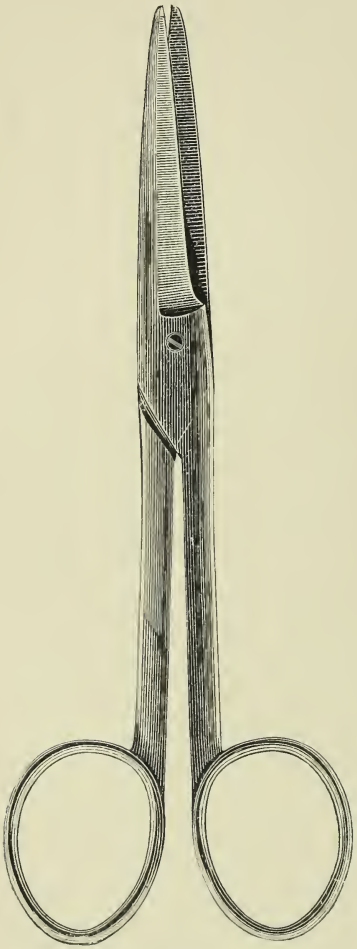

Fig. 6.
BLUNT-POINTED SCISSORS. (Full size.)

placed in a weak solution of sulphurous acid (1-5) for some hours, and are well washed in warm water before being placed in the carbolic solution.

Half-a-dozen towels wrung out of a 1-1000 solution of perchloride of mercury.

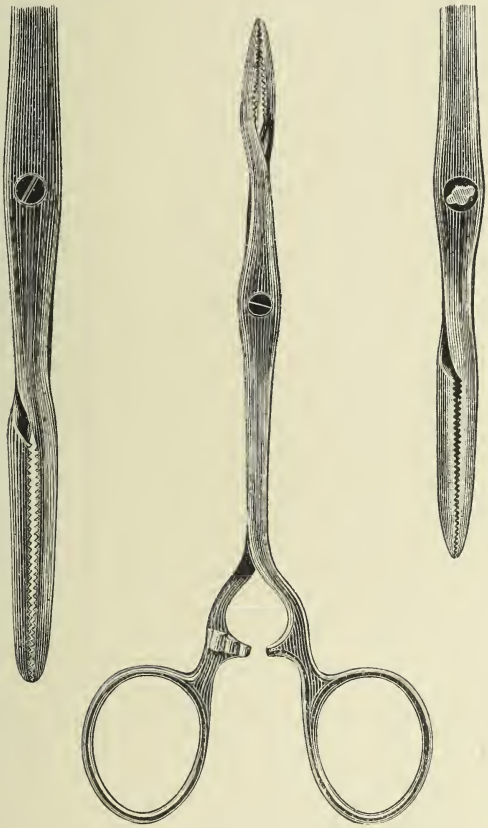

Fig. 7.—Keith's Compression Forceps (Two-thirds size.)

Two india-rubber aprons for the surgeon and his assistant.

One bistoury, light, well balanced, with a $2\frac{1}{2}$-inch blade, and an edge as sharp as it can be made.

One pair dissecting forceps.

One blunt-pointed pair of scissors.

Keith's compression forceps, in three sizes.

Keith's drainage tubes. A set of five, from $5\frac{1}{2}$ to $7\frac{1}{2}$ inches in length.

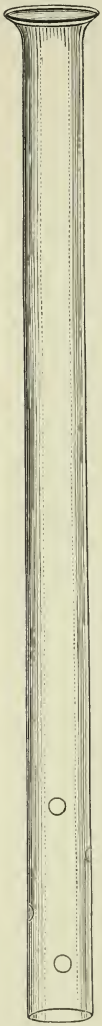

Fig. 8.
KEITH'S DRAINAGE TUBE.
(Full size, shortest length.)

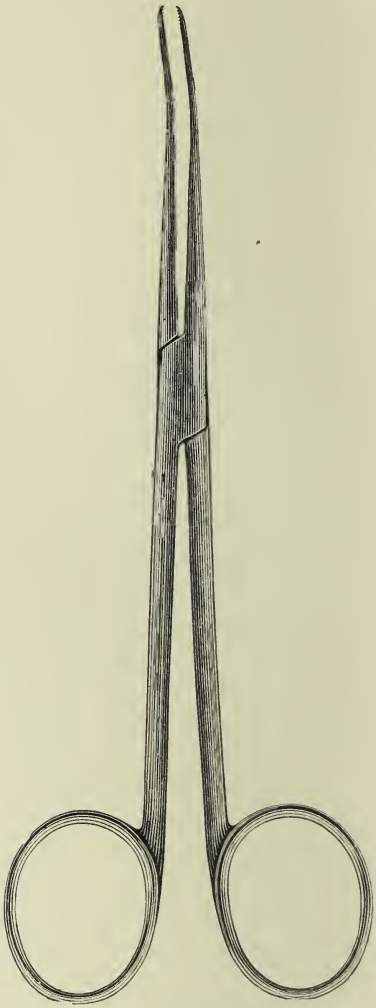

Fig. 9.
LISTER'S SINUS FORCEPS.
(Full size.)

Pure india-rubber sheeting, 18 inches square.
Syringe and cannula for removing fluid from drainage tube.
Lister's sinus forceps.

Silk,—the best make of Chinese twist in two sizes. It is prepared by stretching, then it is boiled for ten minutes, stretched again and kept in a 1-20 solution of carbolic acid until it is required. It will remain for four or five months without becoming rotten; for safety, however, it is better to prepare it more often, and in smaller quantities.

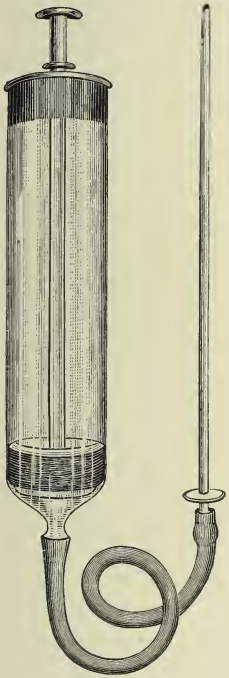

Fig. 10.
SYRINGE AND CANNULA FOR DRAINAGE.

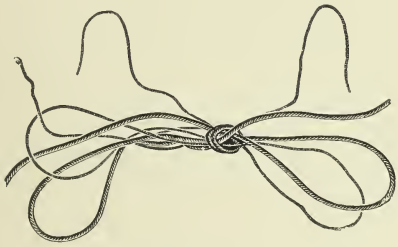

Fig. 11.
SILK FOR LIGATURES AND SUTURES.

Peaslee's needle.

Keith's needles, long and short.

Eighteen inches of thick silk is to be threaded with a needle at each end; and the number of stitches required will depend on the expected length of the wound.

Horse hair for the superficial stitches.

Ordinary prepared catgut.

A tray $2\frac{1}{2}$ inches in depth, into which the instruments and

stitches can be placed, and covered with a warm solution of 1-30 carbolic acid. Trays made of india-rubber are very convenient.

A laryngoscopic mirror for throwing light into the pelvis.

An electric light for operating in foggy weather.

Clover's ether inhaler.

Fig. 12.
KEITH'S NEEDLES.
(Full size.)

Fig. 13.
PEASLEE'S NEEDLE.
(Full size.)

Ether is to be preferred to chloroform. Its special advantage in abdominal surgery is, that vomiting is much less common than after the use of the latter. At the Samaritan Hospital, for example, they are heard to speak of the "usual chloroform sickness." Persistent sickness after the administration of an anæsthetic may mask the onset of vomiting from other and more serious causes. Old people, contrary to the opinion of many, take ether well, if the head and shoulders be kept well raised on pillows.

Many patients find a broad bed more comfortable than a narrow one; the blankets do not feel so heavy, and they do not require so much arranging if the patient be restless. It is easy to get pulled over from one side of the bed to the other, and on to a smooth place. This is perhaps a minor detail, but everything which gives relief is an aid towards recovery. It is not so convenient for the nurse, however, to work over a broad bed.

An ordinary abdominal operation will be performed in the

following way : the anæsthetist is introduced to the patient, and while ether is being administered, the surgeon and his assistant wash their hands, first with soap and water, and then in a 1-500 solution of perchloride of mercury. The patient sees none of the preparations, she falls asleep in bed and wakes up in bed ; and sometimes asks how it is possible to do the operation without making any mess. Surely this is better than the common practice of making a woman, nervous and frightened at least for the time, walk into the room, see several strange men, climb up on to the table, see another table covered with a cloth, hiding she knows not what ; and be strapped down perhaps before she is quite unconscious ! It has been described as "the most awful moment of my life, just as if I were going to be executed." If the operation is not to be performed in the dressing-room, the table, instruments, etc., are quickly brought into the patient's room, as soon as she is unconscious. The table is to stand out from the window, one end being close up to it, the object being to gain as much light as possible. The instruments are placed beside the operator, and when everything is ready, the patient is lifted out of bed and placed on the table, with the head from the window. A hot bottle is placed at the feet ; the night dress is drawn up in front of the abdomen ; and the legs, covered with a blanket, are fixed to the table with the belt placed above the knees. The hands are fastened to this belt by the bandages, and the chest is covered with a shawl. The perforated rubber sheet, which has been previously placed in front of the fire to soften the plaster, is now fixed on to the abdomen, and the legs are covered by the other rubber sheet. It is not necessary to shave the pubes. One of the prepared towels is spread out on the rubber sheeting over the thighs, and another over the chest.

The Incision.

The incision will be usually made through the linea alba, and in this situation muscle need not be exposed. In any other

position it is necessary to divide muscle in addition to other structures. One can usually form a correct idea of the length of the incision which will be required, and the first cut will therefore vary in length from a couple of inches to fifteen or twenty. If the linea alba be not visible the incision is made in a line drawn from the centre of the umbilicus to the centre of the pubes. When cutting down on a tumour which has distended the abdominal walls, it is usual to reach the peritoneum, or at least the fat superficial to this structure, at the first cut. If the surgeon has not sufficient confidence to do this, or has not a bistoury with a sufficiently keen edge, he will expose only the fascia between or over one or other rectus muscle. The line of separation between the muscles is easily seen on account of its whiteness, and a small opening having been made through this, the bistoury can be dispensed with during the rest of the operation. Blunt-pointed scissors take its place. They take the place also of the director, an instrument which need never be used by the abdominal surgeon. The deeper part of the wound, down to the peritoneum, is opened to the full extent of the skin incision. Should there be any hæmorrhage, forceps are to be put on to the bleeding points, as little surrounding tissue as possible being included in their grasp. The peritoneum is caught up with forceps at the upper angle of the wound, and an opening is made with the scissors large enough to admit the finger, which is passed downwards to guard against injury to a displaced bladder while the peritoneum is being fully opened. When cutting down on intestine the same method is used, except that, if there be any difficulty, a straight line to the abdominal cavity can be kept by catching up the tissues on each side with a pair of forceps, cutting between and catching hold again of a deeper layer, and so on until the peritoneum is reached ; this last structure being divided between two pairs of forceps, which raise it up from off the bowel.

The question of the long and short incision was debated for long. Before ovariotomy had been performed fifty times, the

length of the incision had varied from one inch to the whole of the space between the sternum and pubes. A free external incision is a good general rule in surgery, and there is no valid reason why it should not be applied to the abdomen. The incision ought to be long enough to do what is necessary, as easily, as quickly, and with as little exposure and irritation of the intestines as possible, and not one quarter of an inch longer. There is not any advantage to be gained by having the wound half an inch shorter than is convenient; for the length of the incision has nothing to do with the result of the operation, nor with the firmness of the scar, if the wound be properly brought together.

Adhesions.

When there is adhesion beneath the wound, there may be œdema of the wall, or some increased vascularity, though this latter condition, as a rule, seems to go more with adhesions in the pelvis. When the adhesion is very firm there may be some difficulty in telling when one is through the peritoneum, and a little of it may be separated before the mistake is found out. Though experience is the only guide in such cases, it is well to know that the peritoneum may be much swollen, being sometimes nearly as much as half an inch in thickness. Should adhesions be met with, they can be separated either with the fingers or hand, or with a sponge; when very firm, they must be cut. On to every bleeding point, a pair of catch forceps must be fixed, and left there until towards the end of the operation, when in a bad case fifty or sixty pairs may be lying in the abdomen. All do not require to be ligatured, as the pressure of the forceps has checked the hæmorrhage, when the vessels are small. When the adhesions are situated deeply in the pelvis, it is better to tie, without first seeing if the bleeding has stopped, for it is often a matter of great difficulty to get hold of a bleeding artery after it has become retracted into the loose cellular tissue of the pelvis. When the bleeding is from a flat or soft

surface which gives no hold for a ligature, it may be stopped by the pressure of a sponge wrung out of hot water, or the saturated solution of perchloride of iron may be applied to it, either with or without pressure. Oozing of blood will stop of itself; but the abdomen must never be closed so long as there is a suspicion that a large vessel is bleeding. It must be found.

The golden rule in separating adherent growths is, to keep closely to the tumour itself, and not wander off into the surrounding tissues.

The Toilet of the Peritoneum.

The peritoneum is to be left in as natural a condition as possible; blood and bloody fluid must be removed by sponging. This is what Dr. Keith learned at his first ovariotomy in 1862, but it was many years before his example was followed. The original notes of the case are given :—

"Mrs. R., aged forty-nine, applied to me, last August, on account of a large ovarian tumour filling up the whole abdomen, to which her attention had been first directed about six months before. Previous to this her health had been good, she had married when thirty-six years of age, and had borne two children. The catamenia, after some irregularity, finally ceased in December 1861. For some time the tumour gave rise to no inconvenience, and her general health did not suffer, but, by the time it had attained the size of the uterus at the full period of gestation, her health began to give way : the respiration became impeded, locomotion was a labour to her, she suffered much from abdominal pain, and shortly before I saw her, weary of life, she had taken to her bed, with little prospect of again leaving it.

"From the nature of the tumour, which was evidently multilocular, from the extreme rapidity of its growth, from the numerous unmistakable signs that had already appeared of a rapid breaking up of the patient's health, it was most probable that, if left alone, the disease, with its accompanying suffering,

would run its natural course and destroy life in a few weeks or months; and as nothing was to be hoped for either from tapping or the injection of iodine—both dangerous, and but half measures at best—I had no hesitation in recommending ovariotomy. To this, after due consideration, she willingly gave her consent, and it would have been proceeded with without delay, had not a smart attack of pleurisy with considerable effusion supervened. This yielded to the usual remedies, but a month elapsed before she was in a favourable condition for operation. In the meantime the abdomen had much increased in size, from the presence of a large accumulation of fluid in the general cavity of the peritoneum, none of which existed at the time of my first examination of the tumour.

"With the assistance of Dr. Craig of Ratho, Dr. Howden, Dr. Sidey, and my brother, I removed the tumour on the 18th of September 1862. Before opening the peritoneal cavity, thinking I had come down on the surface of the tumour, I separated the peritoneum from its loose cellular attachments, to the extent of two fingers'-breadth on either side of the incision. This mistake happened very easily, but was quickly discovered, and, on opening the peritoneum, there was a sudden gush of a large quantity of straw-coloured fluid. One large cyst containing about eight pounds of fluid was emptied and drawn out, and some cysts punctured; but as no further diminution of the mass could be obtained, it was necessary to extend the incision above the umbilicus, till sufficient space was gained to allow of the tumour being withdrawn. There was but one small band of adhesion. The pedicle, which consisted of the left broad ligament, was short, broad, and thick. It was transfixed, each side was tied with a double ligature, and then divided little more than an inch from the uterus, and so close to the uterine tissue, that a piece of thick cyst wall was left to prevent any chance of the ligature slipping. Owing to the shortness of the pedicle, it was not possible to secure the cut extremity externally. It was, however, brought as near the wound as circum-

stances would permit of, by passing a long acupressure needle through the strip of cyst, and then simply laying the needle across the lower angle of the wound. There was thus considerable tension upon the pedicle, though none upon the ligatures themselves, which were only given a turn round the needle. The edges of the wound were secured by seven needles passed through the whole thickness of the abdominal wall, including the peritoneum. A small quantity of slightly bloody serous fluid was left in the cavity of the pelvis.

"The shock of the operation was slight. Towards evening she complained of severe pain in the lower part of the belly, which was relieved by drawing off her water. An opiate was given her, which she vomited almost immediately, and it was not repeated. She suffered for the first three or four days from thirst and occasional severe attacks of vomiting. No food was given, but she relished very much small pieces of ice and occasionally a mouthful of soda-water, for more than that was instantly rejected by the stomach. The pulse rose to 105 on the third day, and then declined, and never again rose above 90. The catheter was used every four or five hours till the fourth day, when it became unnecessary, the bowels then likewise acted spontaneously and without pain. Some of the needles were removed on the fourth day, the rest the day after, when the wound was firmly united, except at the point where the ligatures came out, and required no support or dressing of any kind except a piece of lint dipped in Condy's fluid laid over the lower angle of the wound. On the fifth day the stomach began to retain some food, which was given in small quantities and of the simplest kind, the treatment being all along strictly antiphlogistic. She was kept very quiet, and was allowed to see no one but her husband and the nurse. The greatest care was taken to keep the air of her room as fresh and pure as was possible under the circumstances of a somewhat limited accommodation, the window being generally open both day and night.

"On the seventh day slight pain was complained of in the left iliac region, where some fulness was felt, as if some pelvic cellulitis threatened. This was accompanied by some considerable irritability of the bladder, and for the two following days she was restless and uneasy, and again suffered from thirst, but without fever. Thinking some matter might be accumulating, for there was very little discharge coming from the wound, I broke up the adhesions round the ligatures to an extent sufficient to admit the finger, and soon after there was a sudden escape of eight or ten ounces of healthy pus. This gave her immediate relief. The ligatures came away with the slough of the pedicle on the fourteenth day, and the day after she was up to have her bed made. After getting into bed she had a good deal of general abdominal pain, and a troublesome irritation in the rectum came on; considerable quantities of bloody, jelly-like mucus passing several times a day. The opening where the ligatures had come out had almost closed, when, on the evening of the seventeenth day, there was a gush of thin dirty serous-looking very irritating fluid, to the amount of ten or twelve ounces. It was so fœtid that it was difficult to enter the room beside her. This discharge continued all day, but during the following night it suddenly ceased after some of the same fœtid fluid had passed by the rectum. That this was the same fluid left in the cavity of the pelvis at the time of the operation I have no doubt. On the twenty-second day the fistulous opening in front had quite closed, and the convalescence after that was rapid and satisfactory. When last seen, in the middle of November, she was going about as usual in the most perfect health."

Sponging is preferable to flushing, a procedure of value only in cases where septic fluid is found in the peritoneal cavity, or where such fluid, or even simply irritating fluid, is put in by the surgeon. In such a case he must of course wash up the mess he has made.

The simplest way of washing out the abdominal cavity is

to use a funnel and an ordinary soft stomach tube. The water, which must be about blood-heat, is poured into the funnel, while the end of the tube is passed into the bottom of the pelvis, and can be moved into the loins, or elsewhere if necessary. The abdomen should be thoroughly filled before the water is allowed to escape, the wound being temporarily closed with the fingers and thumb.

Several gallons of water must often be used, and when the water comes out perfectly clean, the peritoneal cavity is to be dried with sponges before the wound is closed, and a drainage tube must be left in. The necessity for washing out in suitable cases is shown by the following notes. Shortly before the hour fixed for the removal of an ovarian tumour the patient felt as if something had given way, the abdomen was found to be flaccid; and on opening the peritoneal cavity it was discovered that the tumour had ruptured, and that the intestines were bathed in a large quantity of offensive pus. Before the wound was closed, the cavity was thoroughly washed out with a very large amount of warm water, and the patient made a good recovery. It would have been impossible to cleanse the peritoneum in any other way.

In cases where the irritating fluid is confined to the pelvis it is not necessary to wash out the whole of the abdominal cavity; the water is run in up to the level of the brim only, and then sponged out, and this is repeated until the water comes away quite clean.

Drainage.

The idea of draining the peritoneal cavity after operation occurred first to Koeberlee of Strasburg; his tubes, made of glass, were, however, too short to reach to the bottom of the pelvis. Dr. Keith brought home one of these tubes in 1866, and soon saw that the drainage must be from the lowest part of the abdominal cavity, or not at all. He therefore had tubes made of sufficient length to reach from the bottom of the pelvis

to the abdominal wound; specially toughened glass being used in their manufacture, so as to avoid accidental breakage in the abdominal cavity, an accident which has been known to happen.

One must use judgment with the drainage tube, and it is impossible to give exact rules for its use. It is of service only when there is something to be drained; a simple operation requires no tube; a severe one, where there has been much separation of intestine, and when oozing of blood or serum is expected, ought to be drained. In cases where there has been a rupture of old standing, and consequent chronic inflammatory changes in the covering of the intestine and the peritoneum generally, a drainage tube, though apparently necessary, is not required. The tube is to be put in before the stitches are introduced, two fingers being passed into the pelvis to raise the intestine and allow of it reaching quite to the bottom of the Douglas's pouch. As will be seen, the glass drainage tube (Fig. 8) is provided with a small flange to prevent it slipping into the peritoneal cavity, and there is no risk of this happening if the tube be fixed in the following manner. It is usually brought out at the lower angle of the wound, but should it be necessary to fix it at any other part, the method is exactly the same. It must be fixed between two stitches introduced so close together, that when they are tied there is not room for the flange to slip inwards.

Closure of the Wound.

Before introducing the stitches the omentum is drawn down over the intestines, and a small flat sponge placed beneath the wound, to take up any drops of blood escaping from the needle punctures. For the closure of wounds of average thickness it is more easy to pass the needles from within outwards; in thin people one can get on more quickly by using a single needle, passing it through the wall on the right side of the wound from without inwards, and in the reverse direction on the left side.

The whole thickness of the wall is to be included in the stitch, the needle taking in rather less than one-quarter of an inch of peritoneum, and coming out about one-eighth of an inch from the cut edge of the skin. On an average three sutures will be required to the inch, more if the patient be thin. Instead of silk some prefer to use silkworm gut or silver wire; neither appears to have any special advantage, and they are not so convenient as silk. The flat sponge is removed, the sponges are counted by the assistant, not by the nurse; the ends of the stitches are drawn tight, and any air which is present is to be pressed out of the cavity. The stitches are to be tied with a slip knot, which is drawn to the side of the wound, so that the knot does not press on the line of union; they must not be tied tightly; all that is required is to bring the edges together. The ends of the silks are cut off when all have been tied. Stitch abscesses ought to be unknown. A few stitches of horse-hair are to be employed to bring the skin edges together.

Dressing of the Wound.

The wound having been closed, the skin is washed, and the dressing, consisting of ten or twelve layers of gauze thoroughly saturated with the glycerine and carbolic solution, 4 inches in width and somewhat longer than the length of the wound, is put on and covered by dry gauze. If a tube be used, it is carefully surrounded by the dressing, and the 18-inch square of pure rubber is fixed round the top by means of a small opening in this elastic material; one or several sponges, if much serum be expected, is placed over the end of the tube, and the rubber folded over all. In this way the fluid can be removed from the abdominal cavity without interfering with the wound in the slightest. The abdomen is then covered with one or two sheets of cotton wadding, and the flannel bandage put on. Strips of sticking-plaster are commonly used instead of the bandage; but it will be found in practice that this plan does not prevent

flatulent distension of the intestine, and is not so comfortable. The patient is lifted back to bed, in which are several hot bottles; a light shawl is thrown over the head and face, and a dose of morphia, varying from one-eighth to one-quarter of a grain, is given hypodermically. All instruments are removed, the furniture is arranged as before the operation, blinds are drawn down, and the patient is left to the nurse.

The instruments are scrubbed with a nail brush in soap and water, and each one is to be examined before being put away.

Antiseptics.

The foregoing details give our practice in regard to antiseptics. The spray, given up by its parent some years ago, is now practically a thing of the past, it having been proved by experiment that living germs can pass through it unharmed. It has been stated, apparently without any evidence, that the vitality of germs is lessened by their passage through the carbolic acid cloud. Absolutely cleanly surgery is aseptic surgery; it is conceivable that we may fail in our endeavours to be absolutely clean; why then should we not guard against such possible failure, by using antiseptics for the hands, instruments, skin of the patient, and the dressing? By doing this, we can do no possible harm, and we render chemically clean any filth which may have been overlooked.

CHAPTER IV.

AFTER TREATMENT.

The following is a typical history of the satisfactory progress of a patient after an abdominal operation.

Immediately after being put back to bed at noon, one-sixth of a grain of morphia was given hypodermically.

4 hours.—The patient has brought up a little frothy mucus on three occasions. T. 98°, P. 84.

9 hours (evening).—No more vomiting, the skin has been acting freely. Has had a few teaspoonfuls of cold water. Morphia one quarter of a grain. T. 99·2°, P. 100.

20 hours (morning).—Slept several times for an hour at a time, and once for over two hours. Some rumbling of wind in the bowels accompanied by slight colic. Passed water at 4 A.M. for the first time. Five ounces of hot water have been given through the night; thirst not excessive. T. 99·6°, P. 96.

27 hours.—Wind has begun to pass through the rectal tube. Has had a small cup of tea. T. 99·2°, P. 104.

32 hours (evening).—Flatus passing freely without the rectal tube. A small cup of gruel once. Morphia one quarter of a grain.

44 hours.—Slept well. Had tea early in the morning. Pulse and temperature normal.

Evening.—Has had gruel twice and tea three times. No morphia.

Seventh day.—Two tablespoonfuls of castor-oil were given early yesterday morning, and the bowels moved well without

an injection. The wound was looked at for the first time, the deep stitches were removed, and broad strips of sticking-plaster were put across the abdomen to prevent the wound stretching. For the past three days chicken soup has been given once a day.

The bowels were moved again on the tenth day, and on the twelfth the patient sat up in bed, getting on to the sofa two days later. In the second and third weeks the food consisted of bread, fish, chicken, and milk pudding. The patient was fitted with a belt on the seventeenth day, and went home on the nineteenth.

Thirst.

"What can I have to drink? I would like a big drink," one hears said very often. The quantity of fluid must be limited for the first few hours, a teaspoonful of cold water given at long intervals seems to do best; by night time hot water is found by almost every patient to allay thirst well. It must be drunk very hot, almost boiling, and is best given in a horn spoon, the china of a cup burning the lips. Do not give ice, it allays thirst for a very few minutes, and once begun with, the patient is not content unless he has a piece almost constantly in the mouth; and if much be given a greater quantity of fluid is taken into the stomach than one is aware of. In a few days the patient will have a dry sore mouth, and he will then regret that his wish for ice had been acceded to. The quantity of fluid which may be given will vary with the amount of perspiration; somewhere about five ounces will be a fair average for the first night. Should the patient begin to vomit, all fluid by the mouth must be stopped; and an enema of eight or ten ounces of water, or milk and water, may be given for the thirst if necessary; a larger injection is apt to be returned, even when put into the rectum very slowly. Until flatus has passed freely from the anus, showing that the intestinal tract is free in its whole course, the quantity of fluid must not be increased. The

craving for a drink, present in almost every case, rapidly passes away after the first forty-eight hours, if the patient be progressing satisfactorily.

Food and Stimulants.

No food of any kind, unless stimulants be considered as such, is to be given, unless under exceptional circumstances, until the flatus has passed freely. Usually there is not any desire for it, and even when the patient is very weak the strength can be kept up by rectal feeding. After the flatus has passed, a small cup of tea with little milk and sugar, is most grateful and refreshing; then a teacupful of well-boiled gruel or of Benger's peptonised food or some such easily digested farinaceous food may be taken twice during the day. A little brandy or whiskey seems to help the patient over the first night; from ʒii. to ʒss. may be given in an ordinary case; and a somewhat similar quantity may be continued to be given for a few days. For several days the farinaceous food is to be taken two or three times a day; and towards the end of the week, soup may be added to the diet. Until the bowels have been well moved no solid food must be given. Patients who are accustomed when well to take food often will require to have nourishment more frequently than others; but an ordinary person can get along easily on this amount of food, especially if it be helped out by a cup of tea occasionally. As time goes on the nourishment will be increased in amount, and during the second week will consist of fish and other light diet.

When the patient is weak a nutrient enema must be given immediately after the operation, and repeated at regular intervals. Fluids are absorbed with great rapidity from the rectum after abdominal operations; and in practice it is found that it does not matter at such times whether the food be peptonised or not. The quantity injected should be four ounces, and it may consist of an egg beaten up in warm milk and with from ʒi. to ʒss. of whiskey added; or of home-made beef-tea, or any good

meat extract, with a similar quantity of stimulant; or of milk alone with the whiskey. These enemata are to be repeated, at least as often as every four hours; sometimes they will be absorbed if given every two hours; though, of course, the rectum will not stand this for more than a few days. Once in every twelve hours the rectum is washed out with warm water. The following case may be given as an example of one requiring rectal feeding: An unmarried lady, thirty-seven years of age, came from Australia to have an ovarian tumour removed. The patient was much emaciated, and the pulse was usually about 110. The operation was performed in July 1888. The tumour was found to be universally adherent to the peritoneum and the omentum in front, to the intestine and mesentery behind; and the right broad ligament was opened up. The tumour weighed 28 lbs. The patient was put back to bed with pulse at 142. An enema of Valentine's fluid beef and two teaspoonfuls of whiskey was given at once, and was repeated fifteen times in the first thirty hours. As the stomach was very irritable little fluid was given by the mouth; but thirst was not specially complained of. Flatus began to pass thirty-one hours after the operation, and the injections were then discontinued. The stomach was able to retain food in small quantities after the wind passed, and the after progress was satisfactory.

Management of the Intestine.

When flatus has passed freely from the rectum after an abdominal operation, the chief danger is past. We watch for this sign with anxiety, and while we must be ready to assist the intestine in expelling the gas, yet in by far the greater number of cases treatment is not necessary, and may indeed be harmful. It is often difficult to wait and watch, to have faith in nature and to hold one's hand, when it appears that she is likely to fail us. The passage of flatus commences from twenty to thirty hours after the operation; sometimes it may be sooner, at other

times later, even as late as 108 hours has been known. In perhaps 90 per cent. nothing requires to be done except to open the sphincter ani muscle with a tube. This tube—an ordinary glass drainage one will do—is always to be passed into the rectum to the depth of 4 inches or so, occasionally after the first twenty hours; and especially if there be colicky pains passing down to the region of the sigmoid flexure and stopping there. It may be allowed to remain in the rectum for two hours or even longer, when it does not irritate. A simple ointment with cocaine may be used to lubricate the tube, when there is irritability about the anus. Treatment, except by thus opening the sphincter, is to be avoided at first, all that is necessary is to prevent undue irritation of the stomach by not giving too much food or drink.

When treatment becomes necessary it must be prompt, there is not any time to lose, for a few hours of inactivity at the wrong time may easily result in the death of the patient. The symptoms which call for interference are vomiting; distension of the abdomen, either when accompanied by colicky pains or not, and especially when long-continued windy pains have been followed by intestinal paresis. This brings us to the cause of distension, excluding mechanical obstruction; two theories have been advanced, the one is, that the distension is due to commencing peritonitis; the other, that it is due to a paresis or paralysis of the intestine itself. As a variety of the latter must be included the so-called septic peritonitis, as this may be a septicæmia without any definite inflammation of the peritoneum. There is truth in both of these hypotheses, though it is probable that the distension is comparatively seldom caused by peritonitis. We do not have opportunities of examining the peritoneum at the time when distension begins, and it is thus impossible to say with absolute certainty what is the exact pathological condition. A careful clinical study leads one to the conclusion that the sympathetic nervous system has much to do with the condition. This conclusion is strengthened by

the *post mortem* examination of cases of so-called acute septic peritonitis, but which are described more correctly by the single word septicæmia. At such examination no signs of inflammation may be seen except in the neighbourhood of the wound; but some, perhaps very little, red serum will be found. The symptom of distension is common both to these cases of septicæmia or septic peritonitis, and to those of what is usually called simple peritonitis; and it is possible that, as there is little inflammation in the one case, there may also be little in the other. Still there cannot be any doubt that cases of simple traumatic peritonitis are met with.

No two cases of distension ought to be treated by any routine method, and a nurse who has seen the treatment of one case must never be allowed to treat another on her own responsibility and in the same manner. It must be evident to every one that distension, accompanied by increased peristalsis, must not be treated in the same way as when the want of the passage of flatus is due to paresis and cessation of the peristaltic action. When there is paresis, without a previous condition of increased peristaltic action, and consequent exhaustion of the sympathetic ganglia, a stimulant to these ganglia is required. Some hot water may be given; or a teaspoonful of bicarbonate of soda in warm water; or a saline mixture, as ℞ magnes. sulph. ʒi.; magnes. carb. grs. x.; aq. menth. pip. ℥ss.; aq. ad ℥ii. Sig.—The dose to be repeated every two hours until the bowels move; or, and best, the excitement may be given from below. Six grains of sulphate of quinine dissolved in two drachms of whiskey in a couple of ounces of warm water are to be injected into the bowel, and repeated every two hours until three doses have been given. What we have to do is to stimulate the nerve-cells and set up peristaltic action.

On the other hand, when there are frequent colicky pains showing the existence of peristaltic action, and no appearance of the flatus passing downwards, it is evident that it would be a mistake to increase this action; the useless movements must

rather be lessened. For this purpose there is no drug like morphia given hypodermically. This was seen very evidently in the case of a thin subject, where the bowel was observed to be adherent to an enlargement of the kidney. Whenever food was taken peristaltic action was set up, and the bowel could be easily seen distending downwards until it came to this adhesion; here it stopped, an obstruction due to an angle having formed; and, if nothing were done, vomiting came on. A small dose of morphia invariably gave relief, and the flatus could be seen and heard to pass through the obstruction with a gurgling sound.

Some surgeons have been in the habit of giving a dose of opium, in some form or other, at stated times and in every case; others have limited its use to cases of distension, or so-called peritonitis. Naturally, a routine practice of this kind has not proved suitable in every case; and now the tendency is to use this drug rather too little than too much. It is perhaps as great a mistake to use too little opium as it is to give it too often, and especially in too large doses. There is no one drug which is of greater service when given in suitable cases and with a distinct object in view; and none is capable of doing greater harm when used in a haphazard or routine way. The best preparation of morphia for hypodermic injection is the tartrate, and the dose should seldom exceed a quarter of a grain, and will vary from that down to one-twelfth. Sometimes wind will pass after a dose of morphia has been given; under these circumstances the soothing effect apparently relaxes a spasmodic stricture at an angle.

A more anxious condition of the intestine is that of paresis following great peristaltic effort. This means that there is some obstruction to the passage downwards of the flatus, which the muscular action of the intestine has failed to overcome. A rest must be given to the tired-out muscular fibres before an effort is made to stimulate them to renewed action. Give a quarter of a grain of morphia, or even in exceptional cases a larger dose,

and stop all fluid by the mouth. After this dose allow a rest of three or four hours, then give the quinine by the rectum; if the first dose does not set up windy pains let the patient have from one to two tablespoonfuls of castor-oil by the mouth, and continue the quinine until the three doses have been given. Should this fail, give a large enema with turpentine, turn the patient on the side, and if necessary repeat the turpentine injection several times. If there be no septicæmia nor any mechanical block, wind can always be got down, if the proper treatment for the case be used. The following is an example. The operation of hysterectomy was performed on a patient thirty-four years of age on 26th November 1884 :—

5 P.M.—Quiet, no pain.

9.15 P.M.—Ten ounces of urine by catheter, some pain before and a little since in the left side. Morphia one-sixth of a grain. T. 99°, P. 64.

27th (morning).—Slept well. Pain since 5 A.M., thinks that it is wind. Urine fourteen ounces. Stomach soft. No morphia during the night. T. 99·4°, P. 64.

11 A.M.—Pains bad. Morphia one-sixth of a grain.

5 P.M.—Has been very quiet. T. 100°, P. 110.

9.15 P.M.—Felt very sick about eight o'clock, but did not bring up anything; now feels better. One pin of the bandage is a little tight. Stomach slightly full and hard. No wind moving about. Urine is coming away involuntarily. Almost no pain. One-sixth of a grain of morphia and six grains of quinine in solution by enema. T. 101°, P. 110.

11 P.M.—Quinine repeated.

28th (morning).—Has not been awake for any time during the night. Very little wind moving about, the stomach is hard and slightly distended. Rather more so than last night. There is slight drawing up of the upper lip. Had three injections of quinine during the night and one teaspoonful of magnesia. T. 99·6°, P. 88.

11 A.M.—Wind is moving about a little.

1 P.M.—A little wind has passed several times, but the stomach is fuller and hard. T. 99·2°, P. 90.

4 P.M.—Still about as full. Almost total want of expression. Quinine again given by the rectum. T. 99·2°, P. 88.

6 P.M.—Wind passing very freely. The distension is almost gone and there is no tenderness. A decidedly better pulse. Looks quite natural. T. 99°, P. 84.

9.30 P.M.—Quiet with some sleep. Not much wind passing. Stomach rather fuller than at six o'clock. One-sixth of a grain of morphia injected, and the quinine to be repeated at 10.30 if necessary. T. 99·6°, P. 80.

29th (morning).—Flatus passed freely after the morphia, but quinine was required twice during the night to keep it going down. T. 99·4°, P. 80.

The progress of the case after this was satisfactory.

When there is vomiting an endeavour must be made to discover the exact cause: whether it be due to some derangement of the stomach itself; or to mechanical pressure of a distended colon; or to the state of the alimentary tract, as described in cases of distension. When the vomited matter has a sour or sweet taste a half or one teaspoonful of bicarbonate of soda is to be given in six or eight ounces of warm water; this will either act as an emetic or will remain in the stomach, and neutralise the acidity. Sometimes the stomach is washed out; but it is doubtful if this does more good than the soda, and it is undoubtedly fatiguing and distressing to the patient.

Mechanical pressure on the stomach is to be relieved by rubbing the back, or by raising it on a small firm pillow.

When the vomiting is a part of the general state of relaxation and distension, quinine by the rectum will be found to be invaluable; and especially so in those cases where the stomach will not retain any medicine.

Septicæmia.

So far, we have dealt with cases where there was not supposed to be any evidence of septicæmia. The first symptoms of this dread condition are noticed about eighteen hours after the operation; there is some difference in the expression and in the manner of the patient. At the very commencement it is difficult to say exactly what is noticed; there is something not quite natural, and a few hours later this shows itself in the eyes and mouth. There is an appearance of fixation about the face; the eyes have a wild look, and the upper lip is beginning to be drawn up. The manner too has changed, the patient may be elaborately polite, talks in a rapid jerky fashion, and if given a drink, will clutch the cup and put it to the lips quickly and abruptly. There is a look impossible to describe that makes one's heart sink on first seeing the patient. In the commencement it may be passed over, but any one who has seen one well-marked case is not likely ever to forget the appearance. To have the slightest hope of success in the combat with this disease we must throw overboard the good plan of waiting on the natural efforts, for this will lead to but one result. By the time that the first appearance of septicæmia is noticed there may be some, perhaps slight, distension; and all our efforts must be directed to the elimination of the poison by, if possible, free movement of the bowels, and by the action of the skin. The administration of the saline mixture must be begun immediately, and the quinine added to the nutrient enemata. A small dose of morphia will not interfere with the action of the laxative, and will perhaps cause the skin to act. If taken early enough it is possible to believe that an undoubted case of septicæmia might be cured, provided that the absorption of the poison has stopped, and the patient has sufficient vitality to overcome what has been taken into the system. If absorption be allowed to go on the patient must inevitably die. As

soon as we find that the bowels will not move nor the skin act, and feel certain that we are dealing with a case of septicæmia, the treatment ought to be to open up the lower angle of the wound; put in a drainage tube to the bottom of the pelvis, if there be not one already there, being quite certain that it does reach to the bottom of the *cul-de-sac*, and wash out with a large quantity of warm water. It is useless to attempt to wash out by the tube unless an exit be provided for the escape of the fluid. This can hardly be done too soon in a case of septicæmia, but we must be very sure of the diagnosis; for, if the patient be not relieved by the removal of septic matter, the simple opening up of the wound may be enough to turn the balance against him. A lady thirty-six years of age was seen late one evening, three weeks after the birth of her first child. She was vomiting constantly; the abdomen was enormously distended with flatus; the temperature was 103°; pulse 144; and there was no movement of intestine. There was a difference of opinion as to what should be done; one opinion given was, that if the abdomen were not opened the patient would die; and the other, that such an operation would inevitably kill her. All fluid by the mouth was stopped, quinine was given by the rectum, and within a month the patient was able to be out walking. It is at least probable that no relief would have been given by opening the abdomen, and that the operation would have been sufficient to cause the death of the patient. The following is a typical example of septicæmia :—

The operation of hysterectomy was performed on a patient thirty years of age on the 8th of March 1886. The weight of the tumour was 10 lbs., and the operation was performed on account of excessive menorrhagia, so great that at one time she was completely blind and deaf simply from the anæmia. The operation lasted forty-five minutes, the patient was in bed at one o'clock, a nutrient enema was at once given, and was repeated every three hours.

9.30 P.M.—General condition fairly good, tongue moist, little

thirst. Four ounces of urine passed without the catheter. T. 99·8°, P. 84.

9th (morning).—Slept fairly well. Stomach slightly distended, feels sick. Quinine to be given in the next enema. T. 99·8°, P. 106.

Noon.—Stomach much distended. The patient was set up in bed and the back rubbed; some flatus came up, but she was too weak to be kept up long. T. 100·6°, P. 120.

2 P.M.—Much the same, no wind moving about. Has had a third dose of quinine. T. 99·6°, P. 124.

5.30 P.M.—Great feeling of sickness, but very little vomiting. Gave a teaspoonful of bicarbonate of soda in warm water twice; some of it and a large quantity of wind came up with friction. Expression dull, and the patient looks distressed. T. 100°, P. 140.

7.30 P.M.—Still feels sick, but nothing comes up. A turpentine enema was given without stirring up any peristaltic movement. Emptied the stomach and washed it out with a tube passed through the nose. T. 101°, P. 140.

9.30 P.M.—The skin has begun to act for the first time since the operation, the pulse is stronger, and there has not been any sickness since the washing out. Quinine was given with a few drops of nepenthe. T. 102°, P. 143.

10th, 4 A.M.—Sickness has recommenced, the stomach was again washed out and a large dose of sulphate of magnesia was poured in through the tube. Expression rather more natural. T. 101·6°, P. 132.

10 A.M.—After being turned on the side some wind came away. She still feels a little sick. T. 101°, P. 132.

1 P.M.—Expression rather better. T. 101°, P. 126.

4 P.M.—No change.

10 P.M.—No wind has passed since eleven o'clock, and there is no peristaltic action. Quinine and one-sixth of a grain of morphia. T. 101·6°, P. 126.

11th (morning).—Some sleep, no wind passing, abdomen distended, feels tired and weak. T. 101·2°, P. 130.

1 P.M.—Flatus passed several times after the quinine. T. 101°, P. 120.

6 P.M.—Much the same. T. 101·6°, P. 126.

Up to this point, although it was evident that some septic absorption was going on, it appeared as if the patient had sufficient strength to counteract it.

7.30 P.M.—An urgent message was sent by the nurse. Ice was put to the head, and as the patient appeared to be rapidly absorbing the poison transfusion of six ounces of blood was tried with the hope of increasing the vitality, as the woman was so anæmic before the operation. The patient was vomiting, and no wind was going down. Quinine was injected. T. 103·6°, P. 140.

10 P.M.—No improvement. Vomiting, stomach washed out. Much distension of the abdomen. T. 103·6°, P. 152.

The patient died early next morning. Eighty-eight hours after the operation.

Drainage Tube.

When a drainage tube has been left in at an operation performed in the morning, the sponge will have to be changed and the fluid drawn off in the afternoon, and again at night. The rubber sheet is to be opened up without interfering with the dressing, so as to show only the open end of the tube, the cannula is to be passed into the bottom of the tube, and any fluid in the pelvis is drawn out by the syringe. The quantity of fluid sucked up from the abdomen, and what has collected in the sponge, will vary from an ounce or two up to sixteen ounces or more. It will always be more or less bloody, sometimes it will appear to be almost pure blood. At the second dressing the quantity will be much diminished, unless there be hæmorrhage going on, an accident we have never seen. After the second dressing the sponge need not be changed more frequently than once every twelve hours, if the patient be getting on fairly well. At every dressing the tube must be moved by raising, and also by rotating

it ; this is to prevent the passage of a small piece of omentum or of an appendix epiploica into the tube through the side openings. As soon as the fluid becomes of a straw colour the tube can be removed ; or even if it be red, provided that the quantity be not more than a drachm or so. As the tube is drawn out the sides of the wound are pressed together by the finger and thumb, and a fresh piece of dressing is put on. When the rubber sheet fits tightly round the tube and a proper antiseptic dressing has been used, it ought to be impossible to tell through what part of the wound the tube has passed, a few days after it has been taken out.

An ovarian tumour weighing 45½ lbs. was removed from a patient thirty-six years of age. A free incision was made through an œdematous abdominal wall, and an enormous omentum, consisting almost entirely of connective tissue and blood vessels, had to be separated from off the whole anterior surface of the tumour. It bled freely, and over fifty vessels had to be tied. The mesentery was adherent, and there was some easily separated adhesion to the bowel. As the bleeding was still going on freely from the upper part of the abdomen the incision was enlarged, and six vessels were tied in the peritoneum, immediately over the aorta. A drainage tube was put in. The patient was in bed at noon.

5 hours.—Fourteen ounces of very bloody fluid were got away, ten being in the sponges, and four drawn up by the syringe.

10 hours (evening).—Two ounces of fluid, much the same as before.

Second day (morning).—One ounce of less bloody serum.

Second day (evening).—Three ounces of fluid.

Third day.—Three ounces in the morning, and one and a half at night.

The fluid gradually became clearer, and the tube was removed on the morning of the seventh day.

Movement of the Bowels.

It is not of great importance when the bowels are moved after an ordinary abdominal operation. Early in the morning of the fifth, sixth, or seventh day, a large dose of castor-oil is to be given. The patient ought not to be told that he is to get it; while sleepy, the nurse having diluted the dose with soup or hot milk or brandy, simply says "Drink this." The patient will often not be aware that he has had oil, and is pleased to find that the bowels move naturally. Sometimes the first movement of the bowels is not so easy, and the nurse may have to give one or more injections before the intestinal tract is thoroughly cleared.

Removal of the Stitches.

After the bowels have moved the deep stitches can be taken out. The knot is raised by drawing up the ends of the stitch, and the silk is cut below the knot; by this means a hard end of silk is not drawn through along the tract of the stitch. The horse-hair stitches are not disturbed; they, assisted by a broad strip of sticking-plaster put across the abdomen somewhat tightly, prevent the scar from stretching. The wound should be perfectly dry; stitch abscesses mean either bad or dirty surgery.

The patient sits up in bed on or about the twelfth day, and gets up for the first time at the end of a fortnight. The object in keeping the patient in bed for such a long time is to prevent, as much as possible, the risk of phlegmasia dolens; and, should there be the slightest pain or swelling in the calf of the leg, the patient must on no account be allowed to get out of bed until the symptoms have entirely passed away.

Before the patient goes home a firm abdominal belt must be fitted, which will have to be worn during the day for at least a year. For evident reasons it must not be discarded at the

beginning of winter. There is not any advantage in hurrying on a patient too quickly, and a fair average time for going home will be three weeks after most operations. Complete return to health and strength need not be expected for some weeks or perhaps for a few months.

Management of the Skin and Kidneys.

When a patient is not getting on well none of the bodily functions will be natural, they will be all more or less in abeyance. The action of the skin has often too little attention paid to it; as a general rule, it may be stated that, if the skin of a patient can be made to act, progress is satisfactory. A free perspiration within the first few hours after an operation is very much to be desired. It is for this reason that the patient is to be surrounded with hot bottles, and the nurse must see that the hands are kept under the blankets, for there is almost no hope of perspiration if the arms be allowed to lie outside the coverlet. This is certainly irksome to many, but it is of greater importance than at first sight appears, for a moist skin gives relief to the kidneys, and also helps to prevent much or any rise in temperature. If the condition of the patient be not entirely satisfactory, and the skin be dry, we must endeavour to start the perspiration,—by a small dose of morphia—and the reason why it should not be used, combined with atropine, in abdominal cases, is evident; by giving some liquor ammoniæ acetatis by the rectum, either alone, or in combination with a few drops of tincture of aconite, if the pulse be full; or by fomentations on the arms and legs. If, along with a dry skin there be scanty secretion of urine, dry cupping over the back will at times start a perspiration; or a small dose of pilocarpine may be injected hypodermically.

A patient twenty-eight years of age was operated on in the Woman's Hospital, New York, by Dr. Emmet. The case was one of pyosalpinx, and it was found to be impossible to

remove the tube. The after progress, although flatus had not passed, was fairly satisfactory for the first two days; then there was a rapid rise of pulse and temperature to 140° and 103° respectively, accompanied by distension, and stoppage of the excretions from the kidneys and skin. The patient sank rapidly, and by the afternoon looked as if she could live but a very few hours. The loins and back of the chest were dry cupped in twelve places at the same time, the patient being then unconscious. Before the tumblers had been taken off, at the end of fifteen minutes, she was conscious and sweating profusely all over the body, and by next morning the kidneys had recovered their function, and the patient was out of danger. The sequel of this case is also of interest, as Dr. Emmet opened into the tube from the vagina later, and obtained a complete success.

A non-adherent ovarian tumour was removed from a patient aged twenty-two, at half-past ten in the morning, the operation lasting fifteen minutes. One-sixth of a grain of morphia was given as soon as the patient was in bed.

5 hours.—Skin very dry. T. 102·2°, P. 122.

10 hours.—Sweating, urine ℥xxii.; morphia one-sixth grain.

22½ hours.—Sweated little during the night, urine ℥xxxiii. T. 99·6°, P. 106.

28½ hours.—Urine ℥viii. T. 100°, P. 110.

30½ hours.—Flatus passing through rectal tube. Says she feels much better, but looks excited. P. 120.

31½ hours.—Urine ℥x., with a trace of albumen.

33½ hours (9.30 P.M.).—Two ice bags put on. T. 104°.

34½ hours.—No perspiration; feels weak and tired; expression natural. Enemata of beef juice, brandy, and quinine given: sp. gr. of urine, which was 1022 before the operation, is now 1014. Morphia one-sixth grain. T. 102·8°, P. 128.

35½ hours.—Feels comfortable; enemata are to be given every two hours and without the quinine, as the flatus is passing freely. T. 102°, P. 128.

39½ hours.—Urine ℥vi., albumen ⅙ on boiling and adding nitric acid. T. 100°.

41½ hours.—Urine ℥vi., albumen ⅕, a trace of blood; restless; morphia one-eighth grain. T. 101·6°.

46½ hours.—Slept well, has had some gruel. T. 101°, P. 120.

50 hours.—Urine ℥vi., albumen ¼, slight increase in the quantity of blood. Face flushed. T. 100·4°, P. 124.

52 hours.—Urine ℥viii., albumen ⅓. T. 101·4°, P. 124.

55 hours.—No perspiration; looks puffy below the eyes. Ordered a mixture of liq. ammon. acet.; spt. etheris nit.; and mist. camph. T. 102·8°, P. 138.

57½ hours.—Skin still very dry. T. 103°, P. 150?

58½ hours (9 P.M.).—One-ninth of a grain of pilocarpine injected hypodermically; within a minute the pulse was quickened, and the patient said that she felt her heart beating faster, and as if the blood were "surging into her hands."

9.4 P.M.—Palms of the hands are moist.

9.5 P.M.—Feels very sick, ice taken off.

9.8 P.M.—Hands and face are sweating well; the legs are dry. The radial artery, dilated before the injection, is now contracted.

9.15 P.M.—Face, arms, and body are sweating; the legs are moist. Urine ℥x., albumen ⅓, more blood. Feels cold in spite of hot bottles. T. 103°, P. 156?

9.30 P.M.—As the perspiration seemed to be going off, one tablespoonful of liquor ammoniæ acetatis was given in hot water.

10.10 P.M.—Face and hands still wet with perspiration, the legs are moist.

10.45 P.M.—Sweating all over; has vomited once. T. 102.6°, P. 150.

Midnight.—Sweating as before; pulse weaker, vomited four or five ounces of greenish fluid. Morphia one-sixth of a grain.

70 hours (9 A.M.).—Sweated all night. Pulse stronger. Urine ℥viii., albumen ⅓, less deposit and no blood. T. 100·4°, P. 140.

82 hours (9 A.M.).—The skin has been moist all day. Urine ℥viii., albumen $\frac{1}{3}$. Feels very weak; pulse intermitting; digitalis. Ice to head to see if it would soothe and give sleep. Morphia one-sixth of a grain. T. 100°, P. 136.

94 hours (9 A.M.).—Ice had to be taken off as it stopped the perspiration. Liquor ammoniæ acetatis was given.

106 hours (9 P.M.).—Skin moist; urine during the day ℥xxvi., albumen $\frac{1}{4}$. Has felt very weak all day, though rather better than yesterday; has had some tea and chicken jelly; morphia one-sixth of a grain. T. 100·8°, P. 128.

118 hours (9 A.M.).—A fair night, and feels decidedly better; urine ℥xvii., albumen $\frac{1}{1\,2}$; liquor ammoniæ acetatis once during the night; the enemata are still retained. T. 100·2°, P. 124.

130 hours (9 P.M.).—A good day; urine ℥xxv., albumen $\frac{1}{1\,2}$. Has had almost no food by the mouth since the operation. T. 100·4°, P. 120.

142 hours (9 A.M.).—Urine ℥ xxii., albumen $\frac{1}{1\,2}$; enemata coming back, and are to be given every six hours. Is taking a little chicken jelly, and equal parts of milk, water, and lime-water. The bowels were moved with an injection. T. 98·8°, P. 112.

154 hours (9 P.M.).—Enemata are to be stopped. Progress was steady after this point; the stitches were taken out on the ninth day, and by the twentieth the urine was free from albumen; sp. gr. 1020. On the twenty-ninth day after the operation the patient was able to take an eight hours' railway journey. It will be noted that morphia was given in small doses in spite of the presence of albumen in the urine.

Temperature.

It is seldom that the temperature reaches 102°, and if it happen to do so it is usually for a short time only, and the symptom does not require to be treated beyond keeping the skin acting. Should it rise to 103°, rather more active treat-

ment will be called for. What is usually done is to apply cold to some part of the body by passing a stream of iced water through a coil fitting the head or lying on the abdomen. A less cumbersome method is to fill thin sausage-shaped ice bags with small pieces of ice, and place one on the head and one on each side of the neck so as to reach the large blood vessels.

When the ice fails to bring down the temperature, as in the following case, it will be necessary to apply cold to the limbs and abdomen. In March 1886 a non-adherent ovarian tumour was removed from a patient aged forty-five. Progress was fairly satisfactory until forty-two hours after the operation, when the temperature was 102·6°, and the pulse 130. Ice bags were put on the head and neck at this time.

46 hours.—Has had fifteen grains of quinine by the mouth in the past hour. T. 103·8°, P. 134.

47 hours.—Six minims of tincture of aconite. T. 104°.

48 hours.—T. 105°.

49 hours.—Feels as if she were being burnt up. In addition to the ice bags, cloths wrung out of iced water were applied to the legs, arms, and abdomen, and were changed every three or four minutes. T. 106·1°, P. 142.

In half an hour the temperature had fallen to 103·8°, in another half hour to 101·5°, and a quarter of an hour later the temperature was 100·3°, and the pulse 118. The application of the cold cloths was discontinued, the ice bags alone being left on; the temperature did not again attempt to rise, and the patient made a rapid recovery.

CHAPTER V.

THE PERITONEUM.

Peritonitis.

By peritonitis is understood an inflammation of part or the whole of the peritoneum. The causes of inflammation of the peritoneum are very various. It may result during the course of some acute disease, such as a fever, or the inflammation may pass from the substance of an organ to its peritoneal surface. It may also result as a complication in various diseased conditions which we will have to consider later, such as a rupture of the intestine, wounds of the bowel, inflammation and perforation of the appendix, and malignant growths. It may spread from the strangulation of a hernia or an intussusception, from an abscess in the mesenteric glands, or tubercular disease may be an exciting cause. When none of these diseased conditions are present, it may follow on a chill, and in this condition it resembles inflammation in the other great serous cavity of the body, the pleura. It is also described as being a part of puerperal septicæmia, and as a sequel to various operations on the abdomen, but in both of these instances the condition is often one of acute septic absorption, and the pathological changes do not show much appearance of inflammation of the peritoneum. We will take up here the idiopathic form of peritonitis, and afterwards the tubercular. Inflammation of the peritoneum due to surgical disease in the abdomen will be referred to when these conditions are themselves treated of.

Idiopathic peritonitis is divided into the acute and the chronic varieties.

Symptoms of Acute Peritonitis.

The patient may have been in perfect health before the commencement of the disease. It is ushered in sometimes by a rigor, sometimes by a slight feeling of chilliness, and it is not uncommon to find that the patient has caught cold by sitting in a draught, more especially if he has been fatigued and overheated. The feeling of chill may be so slight that it is not noticed at the time, and the first thing observed by the patient is a sudden and acute attack of pain in the abdominal cavity. The pain may be very severe, but it does not cause the symptoms of collapse which are frequently seen when a rupture has taken place. Very quickly the whole of the abdomen becomes tender to the touch, the patient takes up the position which will give the abdominal organs most room, and he draws up the thighs so as to relax the abdominal muscles. Along with the pain and tenderness there is fever, the temperature rising from 102° to 103°, and the pulse becomes rapid, wiry, and small. The expression becomes anxious, the patient is terrified to move or to take a long breath, he cannot bear any weight on the abdomen, and is usually afraid when any one approaches or touches the bed. The tongue is coated and dry, there is a bad taste in the mouth, and, if the case progress badly, vomiting comes on.

The patient may die simply from the severity of the symptoms if the case be neglected; at other times the disease may resolve within three or four days, the temperature falls, the pulse becomes less quick, the pain abates, the bowels move, and the patient is quickly well without any bad results having been left behind.

Between those two extremes there are some cases where serous fluid is thrown out into the peritoneal cavity, in others

lymph is found without fluid. In pleurisy the fluid may become purulent, and there may be a similar transformation in the case of fluid thrown out by the peritoneum during an attack of inflammation. This alteration in the character of the fluid is always ushered in by a chill. If the pus be not enclosed within a limited space by the formation of adhesions, the patient, though eased sometimes from the very acute pain, rapidly passes into a state of collapse and dies within a very short time. The serous fluid which is thrown out may be quickly reabsorbed, leaving no evidences of its presence. Lymph, on the other hand, may leave its traces behind, as shown by the presence of adhesions, and by the formation of bands between one part of the abdominal contents and another.

Treatment.—This consists in keeping the patient quiet and warm in bed, and in encouraging the action of the skin. A hot bottle must be kept constantly to the feet, and the hands and arms must be always kept under the bedclothes. It is useless to expect that the patient can be kept safe from the contraction of a chill if these two precautions be not followed. It is absolutely necessary to keep the patient warm, and this is the only way to do it. The abdomen is to be covered by a large fomentation or a turpentine stupe, a poultice being too heavy, unless it is so thin that it does not keep warm for a longer time than a fomentation, and it gives more trouble. Morphia is to be injected hypodermically, the dose being regulated by the severity of the pain, and it is better to give one-sixth of a grain, and repeat it at a short interval if necessary, than to give a single large dose. If the patient be seen at the very beginning, and if no flatus is passing either naturally or through the rectal tube, then as soon as the pain has been soothed by the morphia, white mixture—sulphate and carbonate of magnesia with peppermint water—should be given every two hours until the bowels move. If this plan of treatment be adopted it must be pushed until the bowels move, but it is to be employed only where nothing is passing *per anum*. So long as any flatus is coming away there

is no necessity to move the bowels until the acute attack is passing off. It is better in those circumstances to give small doses of morphia frequently, just so much as will keep the patient comfortable without paralysing the peristaltic action of the bowels. When the acute attack is over the bowels must be moved by a large dose of castor-oil.

When vomiting comes on it will be accompanied by a relaxed condition of the intestine, and no flatus will be passing down. Under these circumstances the vomiting will be stopped by treatment directed to favouring the downward passage of the contents of the alimentary canal, and this will be done either by the administration of medicine by the mouth or by medicinal remedies introduced into the rectum. When the vomit has an acid or sour taste the acidity of the stomach may be rectified by giving one teaspoonful of bicarbonate of soda in a tumblerful of very hot water. The effect of this will either be an attack of vomiting which will clear out the stomach, or the soda will remain down, neutralising the effects of the acidity, and often passing out of the stomach. Should the soda be vomited a dose of white mixture is to be given; should this come back a second dose will probably stop down, and this is to be repeated every two hours until the bowels move, the medicine being stopped as soon as there is the slightest passage from the rectum. When the soda keeps down and there is no peristaltic action going on, six grains of quinine in solution are to be injected into the rectum, and repeated every two hours until three doses have been given. In some cases where the symptoms are very urgent both the white mixture and the quinine may be given. Whenever there is vomiting all fluid by the mouth must be completely stopped, and if the patient be very thirsty eight or ten ounces of warm milk, or of milk and water, may be injected into the rectum. So long as flatus is passing down fluids and fluid food may be given by the mouth; everything should be hot—hot water, hot tea, hot gruel, hot bread and milk—these are to be given in small quantities, and, with the exception of

water, not more often than every four hours. When a patient is lying in bed, kept warm, and well nursed, there is comparatively a small amount of waste going on in spite of the fever, and as the inflammation is in close relation to the intestinal tract, much food is likely to cause serious inconvenience and irritation, for digestion is certain to go on slowly. When the tongue is dry, showing a want of saliva, the food should be peptonised. Stimulants will be required, or at least will be of service in every case of acute peritonitis; and the quantity and the frequency with which whiskey or brandy is to be given will depend entirely on the general condition of the patient, and especially on the quality of the pulse. It is impossible to give exact directions as to the amount, the only guide being the state of the heart. It is as easy to do harm by over stimulation as it is by giving too little. When the patient is very weak exact directions must be given to the nurse at every visit of the quantity which the patient is to have; that is to say, if the patient is being seen frequently. If the quantity be left to the nurse's discretion, it is quite likely that she will give either too little or will make the patient drunk. There is one sign, however, which may be given for her guidance: it is when the smell of alcohol is noticed in the patient's breath continuously too much is being given, for it shows that the spirit is being thrown off by the lungs. After a stimulant has been taken the odour will remain in the breath for perhaps ten minutes, but if it is still there at the end of twenty minutes the quantity must be reduced.

During the acute attack the urine becomes diminished in quantity and is concentrated. As the attack is passing off it becomes loaded with lithates. Should there be any tendency to suppression the patient must be sweated and dry cupped over the loins and back.

Should there be during the progress of the acute attack a sudden rigor followed by profuse clammy perspiration and symptoms of collapse, we may feel certain that pus has either

formed in the abdominal cavity or that there has been some escape of irritating fluid, due to a complication; and the only thing to do is to open the abdomen, wash out, and drain. The chance of recovery under such circumstances must be always extremely small, but if nothing be done the patient will almost certainly die, and the operation adds little or nothing to his dangerous condition. So long as the temperature does not rise above 102·5° or 103° it is not of very great importance; should it get above 103° ice may be applied to the head and neck. If along with the high temperature the patient is not sweating, eight grains of phenacetine will almost invariably bring down the temperature, and at the same time induce the action of the skin, while it does not seem to cause any depression.

When the patient is getting better the bowels must be moved every second day with a dose of castor-oil or the infusion of senna pods. The steady action of the bowels must always be attended to, to prevent the formation of adhesions. The abdomen is to be painted with iodine as soon as the skin has recovered from the fomenting. This should be done every second night if the skin will bear it, and may be continued for three or four weeks. To prevent staining of the clothes a broad flannel bandage must be worn, and by the time that the application of the iodine is stopped the patient will be accustomed to this belt. He must continue to wear it for at least three months, and must not first leave it off during cold weather. During convalescence the food must be of a non-irritating character, it must be easily digestible, and a return to ordinary diet must not be made too suddenly. The patient must be warned that for a long time he will be liable to a second attack; he must therefore be careful to see that the bowels act regularly, and that he avoids chills. It is a good plan to encourage any one who has had an attack of peritonitis to wear a warm bandage of some kind for the rest of his life.

A very acute attack of peritonitis may be mistaken for

appendicitis, or even for some form of intestinal obstruction. The suddenness of the attack, the diffuseness of the pain all over the abdomen, combined with the elevation of the temperature, will be likely to differentiate this condition from that of obstruction. Appendicitis resembles peritonitis more closely; but in the former there is the localisation of the pain to the right iliac region, a symptom almost always more or less definite; and, at the commencement, retraction of the abdomen rather than a tendency to distension is seen.

Chronic Peritonitis.

The best example of chronic peritonitis is seen where a cyst containing irritating fluid has ruptured into the peritoneal cavity; this accident is followed by an acute attack of inflammation, and it leaves behind a chronic inflammatory condition of the whole of the serous lining of the abdomen. After this acute attack has passed off the patient does not complain of much more than a feeling of discomfort in the abdomen, accompanied by flatulent distension, the temperature is little if at all above normal, and the patient may feel in fairly good health, especially when it is considered how much peritoneal surface is in a state of irritation.

The free fluid in the abdomen, originally due to the contents of the cyst, becomes increased in amount, and, when an operation is performed under such circumstances, the parietal peritoneum is found to be thickened, sometimes having the appearance of cartilage, and it may be quite half an inch in thickness. The peritoneum covering the intestine is swollen, rough, and of a grey colour, with dull red patches appearing through the greyness.

Chronic peritonitis may also follow an acute idiopathic attack, a collection of fluid remaining free in the peritoneal cavity; or, as is more commonly the case, enclosed in a false sac resulting from adhesions and the matting together of the intestine.

Symptoms.—The symptoms of an encysted collection of fluid are sometimes by no means definite. There may be a history of a previous attack of inflammation in the abdomen, as a result of which some distension has remained, or there may not be any such history. A collection of fluid of this nature is usually found in the lower part of the abdomen; fluctuation is to be felt, and there is frequently a want of definition in the outline of the swelling due to the close approximation of the intestine. The presence of this adherent bowel gives a clear note on percussion, closely surrounding the collection of fluid. Pelvic examination may tend to increase the difficulties of diagnosis, especially in the female, for the fluid may be situated in close relation to the uterus and ovaries, or it may be entirely out of reach. Such a fluid may become purulent, its character being changed either as the result of a chill or of an injury, and it will then resemble an empyema. When this alteration takes place it is accompanied by a rigor or a feeling of chilliness down the back; the temperature usually rises, there is profuse sweating, and if nothing be done the symptoms of hectic fever come on. A very prominent symptom of suppuration, especially when the swelling is connected with the pelvis, is the free passage of a mucous discharge from the rectum. This is indeed almost a diagnostic sign of a suppurative collection of fluid situated in Douglas's pouch.

An encysted collection of fluid has been not uncommonly mistaken for an ovarian tumour, and the differential diagnosis may be one of great difficulty. In addition to the physical examination we shall have to rely chiefly on the history, on the swelling not increasing during menstruation, and on the fact that the thinning of the body is either absent or general in chronic peritonitis, while in the case of an ovarian tumour it is more marked about the chest and arms.

Treatment.—The treatment of fluid remaining in the peritoneal cavity after an acute attack consists in rest in bed, in keeping the body warm, in the administration of diuretics and

diaphoretics, with light food, and in painting the whole surface of the abdomen with Churchill's tincture of iodine. If the fluid be encysted it should be withdrawn by very gentle suction of the aspirator, the foregoing medicinal treatment being also carried out. Should the fluid reaccumulate, or should it become purulent, free incision and drainage is the only course to pursue.

The Diagnosis of Ascites.

It is of very great importance that when there is any suspicion of the presence of ascitic fluid the patient should lie with the shoulders low, to allow the fluid to gravitate underneath the diaphragm, pushing it up and thus gaining more room. The intestines are in this way able to float upwards, and as the height to which they can rise is limited by the mesentery, it is very important to get as much fluid as possible out of the way, especially when the abdomen is much distended. Percussion in the centre of the abdomen will give a clear note; in both flanks the note will be absolutely dull; and as the abdomen is percussed towards the middle line it will be found that the note becomes more resonant. Turn the patient on the right side and give the fluid a little time to settle into its new position, and the situation of the clear note will have altered; in the middle line it may be quite dull, while in the left side the note will be tympanitic; repeat the experiment by turning the patient on to the left side, and the dull note previously observed on the right side will now have become tympanitic. When a large amount of free fluid is present fluctuation will be easily felt, and the larger the quantity the more easily will this be made out. When the quantity of fluid is so great that the intestine cannot float up to the surface, the diagnosis may still be made by percussing deeply; but when the distension from this cause is enormous, it may be impossible to be sure whether the fluid is encysted or not. Under such circumstances the size of the abdomen must be

reduced by tapping. As the fluid flows away the intestines will be found to float up against the parietal wall at the highest point; and when the abdomen has been emptied the presence or absence of a tumour can then be detected.

A patient forty-four years of age was admitted into the Edinburgh Royal Infirmary late one night with an enormous distension of the abdomen. She was unable to lie down, and had to sleep propped up in a chair. Next morning, on examining the abdomen, it was found to be enormously distended, and to be dull in every direction, no clear note being obtainable at any point. The abdomen was therefore tapped, over 70 lbs. by weight of fluid being removed; as it was drawn off percussion at the highest level gave a tympanitic note, and when all the fluid had been removed two semi-solid ovarian tumours were discovered. At the operation, which was performed a few days later, both of these tumours were found to be ruptured, and the general peritoneum was in a state of chronic peritonitis.

The shape of the abdomen is a sign on which a considerable amount of stress is laid; it is usually described as being flatter, more distended in the loins, and less pointed, than when a solid or fluid tumour is present. This appearance is certainly seen in all typical cases where there is a moderate amount of distension; but it is a sign on which too much stress must not be laid, for in the case of a flaccid cyst, such as a tumour of the broad ligament, the shape of the abdomen is very typical of the presence of free fluid, although percussion will prevent such a mistake being made. When the abdomen is very much distended the appearance and shape is exactly similar to what is seen when a large tumour is present, and percussion may not be able to give any assistance.

Ascites, the result of general disease, requires to be mentioned. The cases are due to some obstruction in the portal system, or in the heart. Such cases as a rule belong to the province of the physician, but tapping may be required to give relief when medicines fail.

Tubercular Peritonitis.

It is evident that there is a considerable amount of doubt about this condition of the peritoneum. Numbers of cases have been related of a cure resulting after an operation and while it is quite certain that some of these cases have been undoubtedly tubercular, others have evidently been simply cases of chronic peritonitis. The peritoneum has been found covered with small grey masses, and these have been at once called miliary tubercules without further examination, although a similar naked-eye appearance is seen when tubercular disease is not present. Unless a microscopic examination have been made of one of those so-called miliary tubercules, or of the fluid which has been removed, it is impossible to pronounce with certainty whether the disease is tubercular or not. This disease of the peritoneum is more common in children, and the fluid is usually encysted. Suppuration may occur as in ordinary chronic peritonitis. Tubercular disease of the peritoneum is not always accompanied by the presence of fluid, there may simply be caseous masses without any effusion. The fluid resembles that of a simple chronic peritonitis, except that it is more turbid, and little white shreds of tissue are seen floating about in it.

The method for the examination in this as well as in all other diseases where tubercle bacilli are suspected is by staining with fuchsin. Dr. R. W. Philip's exact directions are as follows:

"Place with a needle a small quantity of the deposit on a cover-glass, and press a second cover-glass gently over it so as to spread the fluid as a thin film. Separate the cover-glasses by sliding them apart, and lay them (deposit upwards) on a sheet of white paper.

"Allow the cover-glasses to dry, or gently heat them, and then, with the forceps, pass them three times slowly through the flame of a spirit-lamp (to coagulate the film), taking care not to char the film. Drop the cover-glass (deposit downwards) into a

watch-glass containing fuchsin solution. Heat gently until it steams. After two minutes rinse cover-glass in water, and transfer to methylene blue solution for one minute, and thereafter rinse in water. If the film is quite blue it may be mounted; but if red colour remains replace cover-glass in methylene blue for a moment. When the film is blue dry the upper surface of cover-glass, and mount in Farrant's medium or glycerine. If balsam be used the blue film must be dried before mounting. The tubercle bacilli are stained red; all other bacilli, cells, etc., are stained blue."

SOLUTIONS.

No. I.

Fuchsin	1 part.
Five per cent. solution of carbolic acid in distilled water	100 parts.
Absolute alcohol	10 parts.

No. II.

Methylene blue	1 part.
Twenty-five per cent. solution of sulphuric acid in distilled water	100 parts.

Symptoms.—These may come on rapidly, but as a rule they advance insidiously, and although the disease may be distinctly chronic, it is more commonly subacute. Pains are complained of in the abdomen, and diarrhœa may be a prominent symptom, though this is most likely to be present when the disease is not limited to the peritoneum but has spread more deeply into the walls of the intestine.

The constitutional symptoms are those usually seen in tuberculosis, and consist of sweating, evening rise of temperature, with general deterioration in health. The abdomen is distended with fluid, either generally or in some localised position, or it is drawn in, while some ill-defined masses can be felt. In children the constitutional symptoms are naturally more acute. The diagnosis resembles that of an ordinary case

of chronic peritonitis, with, in addition, the general symptoms of tubercular disease.

Treatment.—The treatment will be divided into general and local, and its exact nature will depend on whether fluid is present or not. The general treatment will consist in improving the state of the health, and will not differ from what is described for tuberculosis in any other part of the body. This is all that can be done for cases where caseating masses without any effusion of fluid are present. When fluid is present it must be removed by tapping, or by gentle suction if it be encysted. Incision and drainage is usually recommended, and when the disease has been discovered owing to a mistake in diagnosis this is the proper course to pursue. When a diagnosis has been made it is not necessary to open the abdomen, unless there be suppuration, until withdrawal of the fluid by tapping has been tried and has failed. When abdominal section is required the fluid may be discovered either encysted in a more or less irregular cavity, whose walls are formed of intestine, adhesions, and any organ in the neighbourhood; or the fluid may be free in the peritoneal cavity, the peritoneum and intestines being more or less covered with small grey sago-like tubercles. In neither of these cases is it necessary to wash out the cavity; drainage is sufficient, and the tube is not to be removed until the fluid has ceased, or almost ceased, to flow. More than twenty years ago a boy eight years of age was tapped for a peritoneal effusion by Dr. Keith. Over a gallon of slightly turbid serum, with large numbers of little grey specks floating in it, was removed, and when the deposit was examined microscopically distinct evidence of tubercular disease was found. Permanent recovery followed this slight operation, and the patient is now a strong and healthy man.

When the fluid suppurates in an encysted cavity it is best to be content with a simple incision and drainage, the wound being closed as much as possible to lessen the risk of a subsequent ventral hernia. A large antiseptic and absorbent dressing

will be required. This is a better plan than sponging or washing out the cavity, as there would be a considerable risk of injuring the adventitious cyst wall, either by making an opening into the general peritoneal cavity, or by wounding the lining surface, and thus allowing of the possibility of absorption taking place. It is wonderful how quickly a cavity of this nature closes up if efficient drainage be carried out from the lowest part. The pressure of the abdominal wall and viscera evidently assists in this rapid closing of the suppurating cavity. An ordinary rubber tube is the proper form of drain to use; a glass one, unless in the lowest part of the pelvis, may press against intestine and cause some injury. The practice of using gauze instead of a drainage tube does not appear to possess any advantage whatsoever, a strip or roll of gauze will certainly drain the thin part of a discharge well enough, but a clot, for example, is simply dammed back instead of being removed. Packing with gauze after the method of Mikulicz does not recommend itself. It also prevents the escape of the thicker discharges, while at the same time it distends the cavity instead of allowing it to contract; besides, its removal may be a difficult, dangerous, and extremely painful matter to the patient.

The after treatment does not present any special difference from that of an ordinary abdominal operation in a debilitated subject.

We may sum up the operative treatment of tubercular disease of the abdomen in this way; when there is absence of fluid an operation is not advisable; when fluid is present it must be removed by tapping; should this fail to effect a cure, incision and drainage should be resorted to; when pus is known to be present, or if it be discovered at a tapping, incision and drainage is the proper course to pursue.

The Presence of Fluid without any Apparent Reason.

Under this peculiar heading will be described a condition sometimes met with, usually in young women, where the

abdomen distends without any apparent reason, and where on examination a quantity of ascitic fluid is found free in the peritoneal cavity. No history will be obtainable to account for the presence of this fluid. There is either no rise of temperature at any time of the day or night, or there may be a slight irregular elevation; the pulse is not quickened, and the general health is not much affected, unless the fluid has been allowed to collect for a long time. Were it not for the absence of any rise in temperature, and of any tubercular symptoms or history, these cases would have been included under tubercular disease of the abdomen, and, doubtless, cases are reported where this erroneous conclusion has been adopted.

Treatment.—The symptom which calls for treatment is simply the increasing size of the abdomen, and what is to be done depends on the amount of fluid which is present. If the quantity be small, estimated at a few pints, an operation is not required; if it be present in large amount it must be removed by tapping. The appearance of the fluid differs from that which is seen in a tubercular fluid; it is clear, of a light yellow colour, and does not contain any of the grey specks which have been previously referred to. We have never had the opportunity of seeing the inside of an abdomen under these circumstances; but probably small grey tubercle-like masses would be seen, exactly similar to what one observes when an ovarian tumour complicated by the presence of simple ascitic fluid is removed. It is this naked-eye appearance which has doubtless misled many operators. Whether the case requires tapping or not, the patient must be put to bed, kept warm, restricted almost entirely to a milk diet, given five grains of iodide of potassium three times a day, and the whole of the abdomen must be painted with Churchill's tincture of iodine. Every one of these cases which we have seen has been permanently cured within six or eight weeks under this treatment. It is equally certain that this condition can also be cured by incision and drainage; but we cannot advise an operation of

this nature—a serious one to the patient, though not so to the surgeon—unless the treatment recommended has not proved efficacious.

Hernia in the Wall.

A hernia due to the stretching of an abdominal cicatrix is unfortunately not very uncommon; its frequency undoubtedly depends on the manner in which an abdominal wound is closed, and on the want of care in providing the patient with a properly fitting and comfortable bandage. The way of suturing the wound has already been minutely described; but it may be repeated that silk imperfectly purified, and stitches too tightly tied, are the common causes of suppuration in the wound. To these causes may be added the want of a sufficient number of stitches, and in addition the failure to give support to the wound when the stitches are removed, and when the scar is still in a soft condition. The plan of suturing the abdominal wall in layers is not necessary. A wound which can stand the test of time can be made by interrupted stitches passing through the whole thickness of the wall, placed at frequent intervals, about three to the inch, and when the stitching is finished the skin edges should be lying as evenly together as if the wound were on the face. It has often been stated that a drainage tube weakens the abdominal incision. We do not know of any evidence in support of this statement, if the drainage tube has been used in the way and of the size recommended by Dr. Keith. When used in the way he has directed it is utterly impossible to tell whether a wound has been drained or not a few days after the tube has been removed. If the tube has been so large that stitches are required to close the opening after it has been removed, or if Mikulicz' gauze-drain has been used, or if a strip of gauze has been pushed in after a large-sized drainage tube has been removed, it is hardly to be expected that a hernia will not result. The belt used after every abdominal operation should be made of stout unstretchable

jean, and it must not be elastic, though this is often inserted to save trouble in fitting. It is to be worn next the skin, and it must be so carefully fitted that straps are not required to go under the thighs. A woman can keep her stockings up by a suspender attached to the belt, and this ought to be quite sufficient to prevent it slipping up round the waist. It is necessary to make the belt fit comfortably, for otherwise the patient will discard it very much sooner than ought to be done.

If a hernia be seen projecting through the scar it may be prevented from getting worse by fixing to the inside of an abdominal belt such as has been described a hollow distensible pad of indiarubber. Large varieties of trusses have been made, few of which answer the purpose for which they were intended if the scar be a long one. When the belt or truss has failed to keep the hernia from increasing in size an operation can be performed if there be not too much gaping of the wall. In an aggravated case it is impossible to bring the wall together properly, and the amount of separation which can be rectified will depend on the size and shape of the abdomen. It is necessary to examine very carefully along the whole length of the hernial opening on both sides, to make certain that the opening can be firmly closed in its whole length before an operation is undertaken. Probably the extreme limit of separation which can be united will be about 3 inches, and it is useless to begin the operation unless the whole thickness of the wall can be brought together without much tension.

The preparations for the operation are similar to those usually employed, and the operation itself consists in the removal of the skin and peritoneum forming the sac, and the refreshing of the edges of the deeper parts of the wound. The stitches must be put in much more closely than usual if there be tension, and the skin edges must be approximated with the very greatest accuracy. When the stitches are removed at the end of a week the abdomen must be thoroughly supported with

strips of sticking-plaster, which are to be kept on or renewed if required for at least three months, and the patient is told that the belt must be worn for at least two years. When there has been a hernia at the umbilicus the diagnosis is very evident, and the operative treatment consists in relieving the bowel if strangulated, and making certain that the contents have been passed back into the peritoneal cavity. The whole of the sac is to be cut away, and the wound closed very carefully, additional support after the operation being given by sticking-plaster. If the bowel have become gangrenous an artificial opening can be made; or if the patient be in fairly good condition the divided ends of the bowel can be stitched together after the gangrenous tissue has been cut away; or the ends may be closed and the continuity of the gut restored by lateral anastomosis, as will be described in the treatment of intussusception. When the omentum has become gangrenous the whole of the injured part must be removed, a chain of catgut or fine silk sutures being used to prevent hæmorrhage from the cut surface.

Abscess in the Wall.

Abscess situated in the substance of the abdominal wall, unless owing to the improper stitching of an abdominal wound, is a rare condition, but one which is occasionally met with. The symptoms do not differ from those of an abscess elsewhere. The whole wall of the abdomen may be infiltrated, it pits on pressure, is painful, and the skin is red.

The *diagnosis* is very evident when the case has advanced beyond the initial stages. The *treatment* consists in poultices, and a free incision as soon as the presence of matter is detected.

Tumours in the Wall.

Tumours of the abdominal wall are sometimes though rarely met with. An enormous deposit of fat, as a part of a general

condition, is not uncommonly seen, and its presence has sometimes been taken for an abdominal tumour. The clear note elicited on percussion ought always to prevent this mistake from being made, but a very fat wall renders the diagnosis of small abdominal tumours extremely difficult, and it is often impossible to estimate the size of small growths in very fat people. This was well seen in the case of a lady who was suffering from malignant disease of the uterus; on vaginal examination it was evident that the uterus was enlarged, but a quantity of firm fat on the abdominal wall prevented any further information from being obtained by bimanual examination. During the progress of a vaginal hysterectomy it was found that, in addition to the malignant disease and the enlarged uterus, there was an old fibroid tumour fully 1 lb. in weight. The growth was of such a size that an abdominal incision was required to complete the operation.

Localised masses of fat or fatty tumours are sometimes seen in the anterior abdominal wall, and when an operation is necessary it does not differ from the removal of such growths elsewhere.

Malignant tumours are met with growing in the wall. These ought to be removed if the incisions can be made entirely free of the disease, and if the amount of tissue to be removed is not so great as will prevent the edges of the wound being brought together. The following is an interesting case, showing how much of the wall can be removed satisfactorily :—

A lady forty years of age was seen in the beginning of 1884 with a hard indurated and irregular tumour situated in the abdominal wall above the umbilicus, and projecting from the mass were two hard rounded nodules each about the size of a turkey's egg. These two nodules were red and angry-looking, and several attacks of hæmorrhage had been caused by their rubbing together. The base of one of these was divided by the thermo-cautery, and the tumour was examined by Professor D. J. Hamilton. His report stated that the tumour was a round-

celled sarcoma, and that its growth was certain to be very rapid; the patient was therefore advised to have the whole mass excised. This was done. The amount of wall taken away measured 11 inches across and 8 inches from above downwards, and part of the sheaths of the recti muscles had to be removed; the number of large arteries which had to be tied was very great. The wound healed as usual by primary union; and now, nearly ten years after the operation, there has not been any return of the growth.

Tumours behind the Peritoneum.

Excluding an abscess, and the very exceptional case where an ovarian tumour has developed entirely behind the peritoneum, retro-peritoneal growths are either sarcomata or lipomata. Tumours in this situation are rare, and it is almost impossible to make a diagnosis. They may grow to a very large size, may be situated in any part of the abdomen, and they resemble tumours connected with the organs near which they are situated. The growths are either solid or semi-solid, and there is really nothing to go on in making a diagnosis, for it is not likely that any two of these tumours will resemble each other.

A lady fifty-four years of age was seen with a solid tumour, which had grown within a few months, and which nearly filled the abdomen. Percussion showed that the whole of the growth was uncovered by intestine; on vaginal examination the uterus was found to be movable, and the tumour could be reached by the examining finger. The patient had got thin, not only on the upper part of the body, but generally, and there did not seem to be any reason to suppose that the tumour was not an ovarian one. The diagnosis was ovarian tumour, probably malignant. At the operation, which was performed in the beginning of August 1889, the tumour was found to be entirely situated behind the peritoneum, and to have no connection with the uterus, ovaries, or any other abdominal organ. The posterior layer of

the peritoneum was divided, and the tumour was enucleated without very much difficulty from the surrounding cellular tissue. Pathologically, the growth was found to be a sarcoma. The patient made a rapid recovery, but within six months a second tumour had appeared in the original situation; nothing further was attempted, and the patient died fourteen months after the operation.

As we have never seen a lipoma growing behind the peritoneum, and as such cases are occasionally met with, the following history of a tumour removed by Dr. Homans of Boston may be given :—

"On 8th August 1881 I saw Mrs. V——. I learned that she had always been well and strong, and had had several children. Her father died at the age of sixty-six of cancer of the rectum, and a brother had died of cancer of the liver. On examination I found a large, fluctuating abdominal tumour, without impulse, and containing solid masses. During the previous six months it had grown rapidly. The umbilical girth was 41 inches. I aspirated the tumour in many places where fluctuation seemed most distinct, but got no fluid, not even blood. The abdominal parietes in the pubic region were œdematous, and the lower limbs had been so. Her complexion was somewhat sallow, but had formerly been ruddy.

"In March 1882, at her request, I operated at her home. Her umbilical girth was now 53 inches, the œdema of the abdominal wall was greater, and her lower limbs were much swollen. The tumour was exposed by a long incision, and appeared to be an immense lipoma. It had originated on the right side behind the peritoneum, and as it grew had pushed the bowels before it. It was adherent to the peritoneum, from which it was more or less neatly enucleated with free hæmorrhage at times. The ascending colon crossed over it, and the cæcum, colon, and appendix cæci were almost incorporated in the mass. The tumour dipped deeply into the pelvis, which it almost filled, and was at length, after considerable hæmorrhage

and much shock, removed. The operation lasted about an hour, and the tumour weighed 35 lbs. She never rallied, and died soon after being put to bed.

"Dr. Gannet reported that the tumour was a pure lipoma."

Cysts of the Urachus are met with so very rarely that they may be classified as surgical curiosities. The presence of such a cyst seems to indicate that there is some very abnormal arrangement of the peritoneum, and occasionally there may be a communication with the bladder. The treatment consists in incision and drainage.

Omentum.

Tumours of the omentum are occasionally met with. Those tumours connected with the omentum itself may be either cystic or malignant. Some cases have been reported of cysts connected more or less intimately with the omentum, but having the structure of ovarian tumours though unattached to the ovary. These growths on careful examination have always turned out to be ovarian tumours which had lost their pelvic connection by twisting and complete separation of the pedicle. Quite a number of such cases have been reported, and on the only one we have met with the ovarian pedicle could be distinctly seen as a tightly twisted cord. A cyst of this kind cannot be classed as a tumour of the omentum. Cysts actually springing from the omentum are usually of small size and of slow growth; the symptoms which they give rise to are slight; they consist in the presence of the tumour, and of a feeling of dragging and discomfort about the epigastrium; associated with these there may be a certain amount of gastric disturbance if the tumour be situated near the stomach.

Diagnosis.—The diagnosis will be made chiefly by exclusion. A tense fluctuating tumour situated more or less in the middle line of the abdomen, freely movable and changing its position as the patient moves, with no pelvic connection, and in some cases

moving freely with the respiration, are the more evident signs of the presence of such growths.

Treatment.—The treatment of omental cysts, when they are giving rise to trouble, consists in their removal. An incision is made over the centre of the growth, in the middle line, if possible, the fluid is withdrawn, preferably with the aspirator, and the sac wall is enucleated; there is usually little difficulty in doing this so long as care is taken to keep close to the cyst. Should there be any difficulty in the enucleation, the puncture opening may be enlarged, and the finger or hand in the interior of the sac acts as a guide during the separation. While the sac is being removed forceps should be put on to any bleeding vessels, and these should be carefully secured with catgut ligatures after the sac has been removed. If the omentum be very much damaged during the enucleation it is better to remove it than to run the risk of the possible formation of a hæmatocele in its layers. A drainage tube is not likely to be required.

Hydatid Cysts.

In addition to these simple cysts of the omentum hydatid disease may be met with, but it is rare. The signs and symptoms resemble those of ordinary cysts, and the only positive diagnosis is the examination of the fluid by the microscope, and the discovery of the hooklets.

Treatment.—The treatment will depend on the exact condition of the omentum; if a single cyst be present it must be enucleated; but if this be impossible it must either be stitched to the wall and drained or the omentum must be removed. If the disease be multiple, and the whole can be got rid of by removing the omentum, a chain of ligatures is made above the disease and the omentum below is divided.

Hydatids of the Peritoneum.

It is probable that there is no such thing as primary hydatid disease of the peritoneum, and that the condition when it is met with has resulted from the rupture of a hydatid cyst in some other organ, such as the liver. The following is an account of a well-marked case of this kind operated upon by Sir Spencer Wells:—

"The best marked case of hydatids of the peritoneum, as distinguished from hydatid cysts of the liver, which I have seen, was a woman in the Samaritan Hospital in 1870-1871.

"The abdomen had all the appearance of a case of multilocular ovarian cyst. Fluctuation was very distinct, but the chief peculiarity of the case was the existence of numerous hard nodules scattered over different parts of the abdominal wall. They were evidently either attached to the abdominal wall or formed part of it, and at first suggested the belief that they must be scattered nodules of cancer. Some of the best marked of these are shown on the drawing near the umbilicus. They were quite as hard as nodules of hard cancer, and some of them being semi-resonant gave rise to the fear that they might be formed on the coat of intestine; but the fact that the disease was of about twelve years' duration, that the patient had borne healthy children during its progress, that she was not much emaciated, did not suffer from sickness or diarrhœa, nor from much abdominal pain nor tenderness, showed that cancer might be almost certainly excluded from the diagnosis, even before hydatid fremitus was noticed. This was most distinct, and the diagnosis was completed by the puncture of one of the nodules felt in the abdominal wall with a fine trocar. A little clear fluid escaped, in which the hooklets of the echinococcus were distinctly seen. No very urgent symptoms being present, nothing more was done, and the woman went home. She was afterwards in the Middlesex Hospital under Dr. Murchison, who also pointed out the hydatid fremitus to his class. She again

went home, and then, after further enlargement of the abdomen, and some signs of chronic peritonitis, was readmitted into the Samaritan Hospital, and I determined to attempt the removal of the hydatids. After making an incision of 3 or 4 inches in length in the median line below the umbilicus some free peritoneal fluid escaped, with numbers of hydatid cysts of various sizes, some quite free, but most of them having some attachment to omentum or mesentery. Several groups of them were removed with the attached portions of mesentery, a few small mesenteric vessels requiring ligature. Between 3 or 4 lbs. of these hydatids, varying in size from a pea to a small apple, were removed. Those in the abdominal wall could not be separated, but I punctured several of the largest, hundreds being still left undisturbed. The wound was closed by suture. No bad symptom followed the operation; on the contrary, considerable relief was given. The patient went home, but I have since ascertained that she died in December 1871. Some of the groups of hydatids were shown at the Pathological Society by Dr. Murchison, and it was considered at the meeting that this was the first instance in which an operation for the removal of peritoneal hydatids had ever been undertaken after the diagnosis had been correctly made.

"Although the origin in this case was not clear, it is extremely probable that it was from the liver. Hydatid cysts of the liver having given way, the dispersed progeny had gone on multiplying, and formed attachments in various parts of the peritoneum."

Mesenteric Cysts.

Tumours growing in the mesentery are usually cystic, but may occasionally be solid, and lipomata similar to those described as retro-peritoneal may also be found in, or at the base of the mesentery. Cystic tumours may be mistaken for a cystic growth of any abdominal organ, more especially for cystic tumours of the ovary, cysts of the kidney, or for hydatids.

Symptoms.—The symptoms are those of a fluctuating tense cyst, usually of slow growth; when they are of small size they may be covered by intestine, and are then more easy to diagnose than when they are large and have pressed the intestines to the side. These growths on account of their size cause inconvenience rather than actual danger to life. The contents vary, they may be filled with a somewhat opaque white fluid, or with chyle, or if there should have been a hæmorrhage into the sac almost any colour of fluid will be seen.

When a tumour which is diagnosed to be one of these mesenteric cysts is discovered in the abdomen it is not necessary to advise immediate operation; they do not of necessity give rise to any inconvenience so long as they are not very large, and their rate of growth may be so slow that an operation can be safely postponed until symptoms arise which render the operation necessary.

Treatment.—This consists in enucleation, or, if this be found to be impossible, the sac must be stitched to the abdominal wall. Both these methods of treating a cyst are described under ovariotomy.

The following case shows how slowly these tumours may increase in size, and how little trouble they may give rise to unless interfered with by operation. A patient twenty-seven years of age was seen in May 1883. She complained of some dragging in the left side, and she had discovered a swelling in that situation about three months before. On examination a hard tumour, about the size of a fœtal head, was found in the left loin, but too far forward to be mistaken for a typical tumour of the kidney. The growth did not appear to have any connection with the pelvis; it was quite insensitive to the touch; it was considerably fixed, entirely covered by the intestine, and it was difficult to say whether it was a solid growth or a tense cyst. A fortnight later the tumour had become much more movable, it could be pushed across the middle line, it felt more elastic, and as if it contained fluid.

By February of the following year there had been no change in the size of the growth. Owing to circumstances unconnected with the case the patient was handed over to another surgeon, who was at first inclined to think that the tumour was connected with the uterus, but changed his diagnosis to that of a renal tumour. The operation was begun under the belief that the kidney would have to be removed, and the ureter was at once divided. Unfortunately this was unnecessary, as the tumour was found to be a cyst of the mesentery, and the kidney was perfectly healthy. Both the kidney and the tumour were enucleated, and the patient recovered after a long and serious illness.

CHAPTER VI.

THE STOMACH.

When we enter upon the consideration of the surgery of the intestinal tract, we arrive at what is probably the most difficult part of the surgery of the abdomen. As it is not possible to say where the province of the physician ends and that of the surgeon begins it is well, in difficult cases, and most are difficult, for the two branches of the profession to work in unison, and so to prevent either too prolonged medical treatment or too early surgical interference. In most of the cases, especially if we exclude the stomach, changes take place rapidly. A patient considered to be doing fairly well may, within twenty-four hours, be in a hopeless condition, and past all chance of successful surgical interference. It is therefore necessary to see a patient often, not leaving to the nurse the responsibility of sending if she observe any change.

The great aim must be to differentiate early the cases which require surgical help from those which do not. To operate unnecessarily is to lessen greatly the chance of recovery; to delay operation too long is a mistake fully as great. Every precaution must be taken to enable us to come to a correct diagnosis of the condition inside the abdominal cavity, for on this naturally depends the line of treatment which will be followed, and we must be prepared to revise the diagnosis, if necessary, at every visit to the patient. The original line of treatment is, however, to be steadily followed, unless a definite

conclusion has been come to, that the diagnosis is wrong, or that there has been a change in the local condition. In attempting to come to a correct diagnosis a careful examination of the history of the patient is of the greatest importance. Not only is it necessary to obtain the precise history of the present attack, but the investigation ought to go back over the whole life of the patient as related to the abdomen. Attention must be paid to any previous attack of abdominal pain which confined the patient to bed; to the state of the bowels, especially important if usually confined; to a history of typhoid fever; and, although it seems hardly necessary to mention that a hernia is a frequent cause of intestinal obstruction, cases have been known where this condition has been overlooked until a surgeon has been called in.

Malignant disease is frequently found in connection with the intestinal tract in such a position that although it is impossible to remove the disease itself, it may be that life can be prolonged or suffering alleviated by means of an operation. The surgeon ought never to insist on any such interference; all that it is his duty to do is to explain to the patient that such an operation is possible, while at the same time he clearly brings forward the immediate risk to life. When this is done it is usual to find that a patient who is weak does not desire to have his life prolonged; he is tired, and willing to go. On the other hand, when the patient is fairly well and is suffering much, he is likely to catch at the idea of anything which offers a fair prospect of relieving him of his suffering. He probably does not wish to die, and feels that life is still worth having if he can but obtain relief. Thus it is that, in cases of cancer of the mouth or the anus, the patient may be clamorous for operation, even although the disease has spread beyond the possibility of a permanent cure. When the disease is situated in the œsophagus, and the stricture has become so complete that the patient is nearly dead from starvation, he will likely reject all idea of an operation, the wish to live having passed away.

A number of operations have been performed on the stomach and intestines, some curative, some palliative, and others which may be looked upon somewhat in the light of surgical feats, hardly as triumphs of surgery. According to their situation they may be divided into two classes, those involving the stomach and those having to do with the intestines.

The difficulty of diagnosis has been briefly referred to, and a few words may now be said on the difficulty of exploring the abdominal cavity after it has been opened. To any one accustomed to perform operations on the abdomen the removal of a simple growth, such as an ovarian tumour, is entered upon with complete confidence; it is otherwise when the operation is begun for some abnormal condition of the intestinal tract, especially in the intestine. The risk is great, there is often considerable doubt as to the exact diagnosis, and the actual difficulties to be met with in the operation itself may be extreme.

If possible no one should begin his practice in the surgery of the abdomen with such a case. Some lay great stress on the advisability of operating on the dead body, and to those who have had no surgical training this will be somewhat of a help, though to the touch and the sight the difference is great in the living and in the dead body. Here, as elsewhere, actual experience is clearly necessary before the highest excellence can be reached; and it is fortunate that this can be gained without at once commencing on the most difficult class of operation.

Position of the Stomach.

It is not possible to describe definitely the exact position of the stomach, for it is an organ which is constantly varying in size, and which is only fixed, and that relatively, at one point, viz. at its cardiac or œsophageal orifice. A point in front of the seventh costal cartilage, rather more than one inch from its junction with the sternum, indicates the position of the œsophageal opening; but even this although the most fixed point,

and more especially the position of the stomach itself, may be materially altered by the pressure of surrounding organs, as well as by new growths. Posteriorly, this opening is on a level with the spinous process of the ninth dorsal vertebra. When comparatively empty about three-fourths of the bulk of the stomach are situated vertically, the remaining fourth, towards the outlet or pylorus, being placed horizontally. The surfaces look anteriorly and posteriorly; the borders are upper or right and lower or left,—the former constituting the lesser, and the latter the greater curvature.

Close to the pylorus there is a slight dilatation, termed the antrum pylori. The pylorus or opening between the stomach and duodenum is situated at the lower end of the stomach. It is directed backwards, and varies much more in position than the œsophageal or cardiac opening. When the stomach is empty the pyloric orifice will be found about half an inch above a horizontal line "drawn around the body at a level corresponding to the most dependent parts of the tenth costal arches" and "about $4\frac{1}{2}$ inches below the lower end of the gladiolus" (Cunningham). As the stomach distends its position alters, it rotates on itself, so that the anterior surface, which bulges more than the posterior, looks forwards and upwards, and the greater curvature turns towards the front, while the pylorus moves towards the right and becomes closely related to the neck of the gall-bladder.

When the stomach is abnormal, either from a simple distension or when there is a tumour at the pylorus, this orifice may be found at any part of the abdomen, even in the right iliac region.

Unless the stomach is somewhat distended its anterior surface is not in actual contact with the abdominal wall. As it distends it abuts against the parietal peritoneum below the ensiform cartilage, chiefly to the left, the space being bounded by the edge of the ribs on the left side, and the liver on the right, the lower margin, in average distension, being a transverse

line at the level of the junction of the ninth or tenth costal cartilages with their ribs. To understand the surgery of the stomach it is necessary to refer to its peritoneal relations, especially with regard to the posterior surface of the organ, and to the tranverse colon; to the formation of the transverse mesocolon, and the greater and lesser omenta.

The Peritoneum.

From the under surface of the diaphragm to the posterior aspect of the liver the peritoneum is continued as the superior and inferior layers of the coronary ligament of the liver; the former may be traced over the convex surface of the liver to its anterior free border, and from thence on the inferior surface as far back as the transverse fissure; the latter passes forwards on the inferior surface of the liver to reach the transverse fissure. Along the line of the transverse fissure these two layers come into close contact with each other. From this point they descend to the lesser curvature of the stomach as the gastro-hepatic or small omentum, and having separated to enclose the stomach they again come into intimate contact with each other along the line of the greater curvature, forming the gastro-splenic omentum or ligament in the interval between the stomach and spleen.

From the great curvature of the stomach they may be traced downwards in front of the transverse colon for a variable distance, —in some cases extending as far as the brim of the pelvis. Doubling backwards upon themselves they pass upwards to meet and enclose the transverse colon, at the upper border of which they again come into contact, but between them there now lie the ramifications of the middle colic vessels, which carry the peritoneum back to the posterior abdominal wall under the name of the transverse mesocolon. Having reached the posterior abdominal wall at the lower border of the pancreas the two layers of the transverse mesocolon separate from each other.

One passes upwards in front of the body of the pancreas and

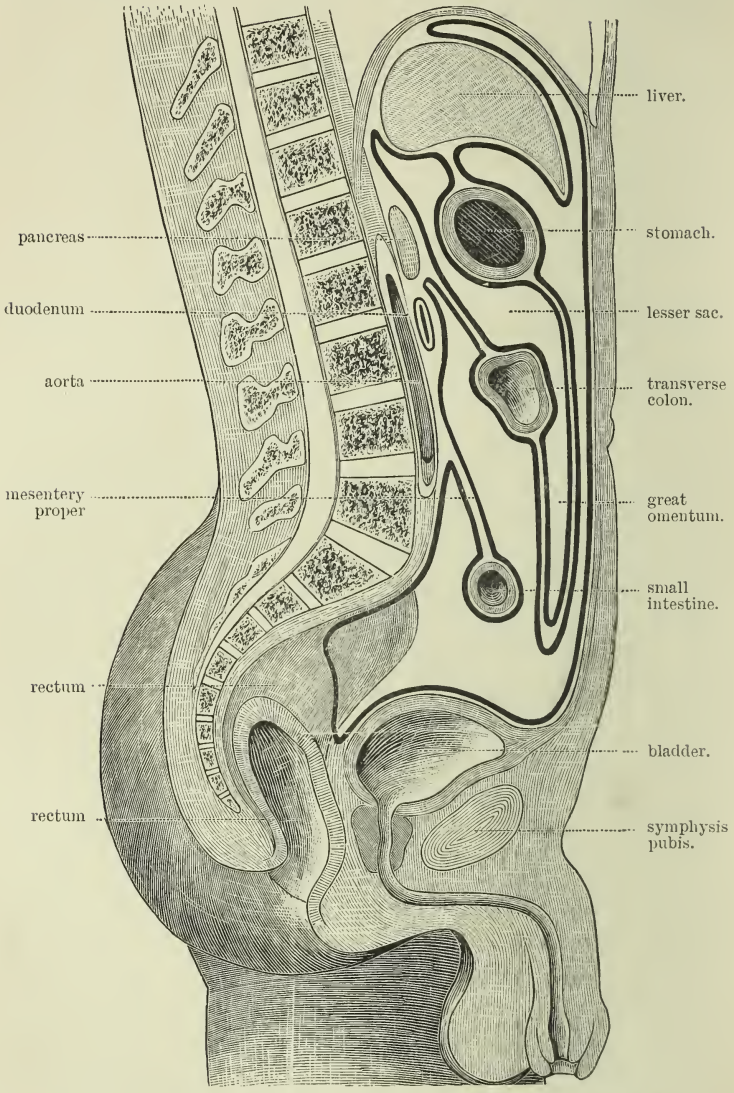

Fig. 14.—Diagram to illustrate the Continuity of the Peritoneum in the Vertical Direction. (Cunningham.)

the cœliac axis to reach the diaphragm and become continuous with the inferior coronary ligament of the liver and so complete

the circuit of the small sac of the peritoneum. The other, or lower layer of the transverse mesocolon, descends in front of the third part of the duodenum, and the ramifications of the superior mesenteric vessels, envelops the small intestine and returns to the posterior abdominal wall upon the reverse side of the superior mesenteric vessels, thereby forming the mesentery. Once more this layer of peritoneum passes downwards, clothing the posterior abdominal wall as far as the pelvic brim. Descending into the cavity of the pelvis it forms the mesorectum. Having formed the recto-vaginal and utero-vesical pouches in the female, or the recto-vesical pouch in the male, it reaches the anterior abdominal wall, and continuing upwards to the diaphragm the superior coronary ligament of the liver is reached and the circuit of the great sac of the peritoneum completed. The continuity between the cavities of the great and small sacs is found at the foramen of Winslow, which is situated immediately posterior to the right free border of the small omentum. That part of the peritoneum which is suspended from the inferior border of the stomach is known as the Gastro-colic or Great Omentum, and since it is doubled upon itself prior to investing the transverse colon, it follows that below this part of the colon the great omentum consists of four layers of peritoneum.

The blood supply of the stomach is derived from all the three branches of the cœliac axis. The gastric or coronary artery runs along the lesser curvature from left to right, giving off transverse branches to both surfaces of the stomach, and anastomosing near the pylorus with the pyloric branch of the hepatic artery. The splenic artery gives off the vasa brevia arteries to the cardiac end, and the gastro-epiploica sinistra to the greater curvature, while the gastro-epiploica dextra, with which it forms an anastomosis, is given off from the gastro-duodenal artery, a branch of the hepatic.

The branches of the pneumogastric nerves can be seen on the walls of the stomach, the left supplying the anterior surface and the right the posterior.

Numerous filaments from that part of the solar plexus which surrounds the cœliac axis, viz. the cœliac plexus, are also to be found on the stomach, carried thither by the arteries already mentioned.

Before leaving the anatomy of this part of the abdomen the gastro-hepatic or small omentum must again be referred to. The right free border of this double layer of peritoneum forms the anterior boundary of the foramen of Winslow. Between these layers the portal vein, the hepatic artery, and the common bile-duct are found,—the artery being in front and to the left side, the common bile-duct in front and to the right side of the vein which is between but on a plane posterior to both. Behind the foramen of Winslow is the vena cava inferior. At this opening, therefore, it is not possible to do much surgically.

Operations.

The operations which can be performed on the stomach are the following:—

Gastrostomy, or the formation of a fistulous opening between the stomach and the outside of the abdomen, is performed when food cannot pass through the œsophagus, the obstruction being caused either by simple cicatricial contraction, from pressure from the outside, or by malignant disease.

Gastrorraphy signifies the closure of an opening into the stomach, which is the result either of an operation, of a wound, or of ulcerative destruction.

Gastrotomy, or incision of the stomach, is performed for the purpose of removing foreign bodies, or as a preliminary to the forcible dilatation of a contracted œsophageal or pyloric orifice.

Gastrectomy means the excision of a part of the stomach.

Gastro-enterostomy is the operation which is performed when it is necessary to make a fistulous opening between the stomach and some part of the intestine.

Pylorectomy signifies the removal of the pylorus. The

last three operations will only be performed when there is malignant disease either of the stomach or pylorus.

Loreta's operation and pyloroplasty are performed when there is a non-malignant stricture of the pylorus. The first consists in stretching the contracted pyloric orifice, and the second in dividing the stricture and stitching in the way which will be described later.

None of these operations are performed frequently, and the mortality overhead is very great. We do not need to go far to seek the reason of this, for the majority of the operations are performed for malignant disease; and, as they are usually only palliative, they are often and not unnaturally put off by the patients as long as possible.

Gastrostomy.

Gastrostomy is the operation on the stomach which has been performed with greatest frequency. The object of the operation is to make an opening into the stomach after it has been fixed to the abdominal wall for the purpose of introducing food when the œsophagus has been closed by disease. If food cannot be got into the stomach or small intestine it is impossible to keep a patient alive, as rectal feeding always fails to support life for any lengthened period.

The operation may be called for when the œsophagus is closed by malignant disease, or by simple cicatricial contraction, or when it is closed by pressure from the outside; and it has been performed for cancerous disease of the mouth and pharynx. It is said that it might be performed for congenital obliteration of the œsophagus, and if this were discovered it might be done; but whether the patient, if he or she survived, would be grateful, is very doubtful.

Diagnosis.—The diagnosis of stricture is not a difficult one. The first symptom which is noticed when there is malignant disease may be local or general. The health may have begun to suffer before any difficulty is felt in swallowing. As one would expect,

it is solid food which first passes with difficulty into the stomach. The patient finds that he has to be more careful in chewing his food, or he gets into the way of cutting it into small pieces. The difficulty increases, and after a time the patient has to give up solid food entirely, and limits himself to fluids. These he swallows less easily as time goes on, until finally nothing will pass, and the patient then dies of starvation. Before this happens other symptoms will have arisen; food begins to regurgitate at times, either immediately, or, if a pouch has formed above the stricture, some time after it has been taken. It may be tinged with blood, or mixed with mucus or with pus, and decomposition will often render it most offensive. There is often great irritation of the throat, accompanied by expectoration of mucus, discomfort in some part of the œsophagus, and sometimes pain between the sternum and spine, especially near the seat of the disease. The diagnosis is confirmed by the passage of a bougie, and by auscultation of the œsophagus. In passing a bougie a soft instrument ought always to be used, as the tissues may be extremely soft and friable, and as any rough manipulation may result in sudden death of the patient by rupture into a large blood vessel. The possibility of an aneurism must be excluded by auscultation. When the head is thrown back, the average distance from the incisor teeth to the entrance into the stomach is about 14½ inches, and it is not necessarily longer in a tall man; indeed, height does not seem to have any relation to the length of the œsophagus. Some shreds of tissue may come away with the bougie, and these may be examined microscopically, though there is usually not much difficulty in diagnosing between simple and malignant stricture. Auscultation of the œsophagus is a perfectly harmless method of diagnosis, and gives as satisfactory, and indeed in some cases, more positive results than are derived by the passage of a bougie. The œsophagus is to be auscultated, in the upper part in front, as far down as the sternum. To follow its course onwards to the stomach the stethoscope must be placed on the back, to the left

of the spine and over the transverse processes of the vertebrae, commencing at the second, and ending at the eighth or ninth dorsal. One must be accustomed to recognise the normal sounds made by the passage of fluid through the œsophagus, and attention must always be directed to endeavouring to ascertain what is the usual time the fluid takes to reach the stomach. This is done by placing the fingers of one hand on the thyroid cartilage while listening behind; the action of the thyroid will show when the fluid starts, and the stethoscope when it has reached any given point. There is a very appreciable length of time taken for fluid to pass between the level of the thyroid and the lower part of the œsophagus. It is not possible to describe in words the sound which is conveyed to the ear in a healthy œsophagus; when there is a narrowing, one naturally expects to find the sound lessened at that part; or, if the stricture be complete or nearly so, there will be sudden stoppage of the sound in an abnormal position; and in some cases it will be even heard to ascend. Minor symptoms consist in general derangements of the stomach and bowels; flatulence and colic one would expect; there may be constipation, or a tendency to diarrhœa, or these conditions may alternate.

There is not much difficulty in the diagnosis of simple stricture; the history of having swallowed some corrosive or caustic fluid is all-important. This is followed, at a variable length of time, by a gradually increasing difficulty in swallowing. There is not so much likelihood of blood or mucus being mixed with the regurgitated food, nor will the microscope show any signs of malignant disease. In other respects the cancerous and non-cancerous strictures resemble each other, except that the cachexia in the latter is not so distinct; starvation stares the patient in the face in both.

Outside pressure is usually caused by an aneurism,—probably situated in the left carotid or subclavian artery—or occasionally by a malignant tumour in the neck; but it is not likely that an operation on the stomach will be called for, as the disease will

either require other treatment, or the condition of the patient will be such that an operation of this nature will be contra-indicated.

Treatment.—When considering the treatment one must take into account the cause of the stricture, whether simple or malignant, although it is evident that, whenever there is a complete obstruction in the œsophagus, the only way to prolong life is to make an artificial opening somewhere into the stomach or upper part of the intestinal tract, and the stomach is the part that will be chosen for this purpose. When the stricture is not malignant; when the block is caused by outside pressure; when the patient is unable to swallow solids, and there is so much difficulty with fluids that he is not sufficiently nourished; and, in addition, when the treatment by the passage of bougies has failed to prevent increasing contraction of the stricture—then there ought to be no doubt as to the propriety of advising the formation of a gastric fistula, and that without any further delay. When the stricture is due to malignant disease it is impossible to give such definite advice. The disease, be it remembered, is a progressively fatal one; all that we can hope for is relief from death by starvation and from pain and discomfort, by placing the diseased part at rest. If the surgeon be of opinion that the case is a suitable one for operation, he should not wait too long before putting the matter before the patient. When he does bring the subject forward it is not his duty to advise the operation, he ought simply to inform the patient exactly what he has to expect if nothing be done, and how much he may gain or lose by having it performed. In any case the patient has not much to lose, he is suffering and starving, and he knows that when he is unable to take a sufficient quantity of food the end must soon come, even if rectal feeding be carried out with the greatest care and the most scrupulous attention to the selection of the most suitable foods.

The mortality of the operation is high; this is due undoubtedly to the fact that it has often been performed too late, and when the patient has been too much reduced by starvation;

and also, it has frequently been performed by those unaccustomed to abdominal work. Overhead the mortality may be roughly put at betweeen 30 and 50 per cent; but when the operation is performed early enough, and skilfully, this death rate ought to be very much reduced. Suppose the patient to recover from the operation, how long is he likely to live? If very fortunate he may last out a year, and for at least part of that time he may be in good health; and, when the end does come, it will come more easily. After these facts have been clearly brought before the patient, and if he choose to run the risk of dying after the operation, with the hope of living a little longer than he would otherwise do, the surgeon is fully justified in performing gastrostomy for malignant disease of the œsophagus. This is, however, a matter of opinion, and the late Professor Spence of Edinburgh wrote: "To perform gastrostomy in such cases is, I think, absurd, and would bring little credit to surgery."

The operation may be performed in one stage or in two. The stomach may be opened either at the time of operation, or after adhesions have formed between it and the abdominal wall. As the incision into the stomach itself is not painful, there is no special advantage in opening the viscus at the time of the operation; nor is it necessary to wait until the adhesions are very firm. Undoubtedly the proper time for making the opening is when it becomes necessary to put food into the stomach. In a very much debilitated subject this will be as soon as all fear of sickness following the administration of the anæsthetic is past, say towards the end of the first twenty-four hours.

When the patient is in fair condition, and when the strength is well maintained by means of enemata, it is better not to make the opening until the third or fourth day. The advantage of waiting a few hours is, that lymph will have been thrown out between the stomach wall and the parietal peritoneum, thus lessening the possible risk of the escape of fluid into the peritoneal cavity.

The preparation before the operation consists in moving the

bowels by injection, and the thorough purification of the skin. In this, and in all operations on the intestine, especially where the patient is much run down, it is of the utmost importance to avoid lowering the temperature. He should be warmly clad, and the indiarubber sheet used in ovariotomy must be made use of, as it not only prevents wetting, but keeps in the warmth. The patient should also be surrounded by several hot bottles.

The more usual incision is one parallel to the ribs on the left side. It must not be made too close to the costal margin, but about one inch from it; this is for the purpose of allowing stretching of the wound. The incision should not be made so short that manipulation is rendered difficult, as the time taken in the performance of the operation would therefore be prolonged. It will probably be nearer three inches than two, and its exact position will depend on the situation of the liver. As the patient is usually emaciated there is no difficulty in mapping out the lower edge of the left lobe of the liver in the epigastrium; this is fortunate, for the incision ought to commence slightly below the edge of that organ, and be continued downwards and outwards for the desired length. The incision is made in the usual way, the straight line to the peritoneum being kept by forceps. Some prefer to make a vertical incision through the left rectus muscle; it is not of great importance which of those two ways is chosen, though the former is, on the whole, the more convenient. When the peritoneum is opened the stomach will in all probability be out of sight behind the ribs, the omentum or transverse colon being found presenting. The stomach is reached either by drawing the omentum downwards, or by passing the fingers underneath the left lobe of the liver, crossing the spine, and there the lesser curvature is come on immediately below the diaphragm. The organ is in this way drawn forward into the wound, and the part which comes up with least traction is fixed on for the opening. It does not matter to which part of the parietal wound the stomach is attached; as a rule the upper part will be found to be the

nearest point, and where there will be least traction. As soon as the point of opening in the stomach has been fixed on, a silk stitch is passed through its two outer coats, taking a good grasp of the wall; a loop is made of this, and it is used in future manipulation. Various plans are adopted for fixing the stomach to the wall, and here, as in intestinal surgery, too many sutures are commonly used, and too little is left to nature. The principle is to bring as large surfaces of peritoneum as possible into apposition, and to do this by as few stitches as will keep the surfaces at rest and prevent any leakage. As good a method as any is that described in the chapter on ovariotomy for fixing an irremovable sac to the abdominal wall. A round-pointed needle threaded with silk is passed through the abdominal wall, so as to leave a third of an inch or so of peritoneum free; it then is passed through the stomach wall in a direction parallel to the wound, and excluding the mucous coat, for fully a quarter of an inch; then it is returned through the parietal wall. The ends of the stitch are left loose until the others have been introduced. Six stitches ought to be sufficient. Should the parietal wound be too long it can now be closed; this will probably be done most conveniently at its lower end.

When it is definitely determined not to open the stomach for five or six days, stitches may be altogether dispensed with. The incision is made as before, the loop is put into the stomach wall where the opening is to be, and then a harelip pin is passed through the stomach, taking in the two outer coats for a distance of from one half to one inch; the direction of the needle will be at right angles to the abdominal wound, and an inch or so below the silk loop. A second pin is passed in the same way as the first, but at an equal distance above the silk loop. The ends of the needles are supported by the skin on both sides, and in this way a considerable amount of the surface of the peritoneum covering the stomach is brought against the peritoneum of the abdominal wall. Below the ends of the needles a small piece of soft dressing is placed, gauze soaked in glycerine and carbolic

acid being suitable; and, to guard against all fear of accident, the points of the pins may be broken off.

The one precaution that must be remembered when incising the stomach is to be careful not to make a large opening. The aperture may be made with a fine tenotomy knife; as the knife is withdrawn a probe should be passed into the opening, as there may be difficulty in finding it at first, due to bulging of the mucous membrane. A piece of a fine gum elastic catheter, No. 6 or 8, is introduced, and four ounces of warm peptonised milk are run through a funnel into the stomach. The little difficulty of getting a funnel to fit is overcome by fixing a piece of rubber tube to the end of the catheter, and it is usually better not to remove the tube at first on account of the difficulty with the mucous membrane. For the first few days digestion must be made easy by having all food peptonised; at the end of a week this is no longer necessary. During the first week, food, which ought always to be warm, is to be given not more frequently than every four hours, and the quantities will vary with the necessities of the patient; as soon as possible regular meals should be taken. No gastronomic pleasure is to be obtained by food passed directly into the stomach, and many attempts have been made to manufacture an artificial œsophagus, so that the patient may masticate his food, and then send it through the outside canal to the stomach. The advantage is that the food is thus mixed with saliva, but in actual practice, the apparatus is not found to work well, as the patient unintentionally swallows some of the food, and this is naturally followed by vomiting. The simple ingestion of food into the stomach is followed by a profuse flow of saliva; this is always a great inconvenience, but it may sometimes be alleviated by the administration of small doses of belladonna. There is a tendency to protrusion through an abdominal wound which has healed by granulation; it is therefore well to keep the scar as narrow as possible by drawing it together with a long strip of sticking-plaster. The reason why it is advisable

to make the wound into the stomach as small as possible is to prevent the escape of gastric juice. A little will often come away, and it can be absorbed by a pad of wood-wool wadding, or some similar material. The following case illustrates the immense amount of suffering which might be entailed if this precaution were not taken. A poor woman of thirty-nine years of age was kicked in the stomach by her husband. The injury was followed by the formation of a swelling in the upper part of the abdomen. One day the skin ruptured, and a quantity of pus was discharged. The opening became much smaller, but never entirely closed, and when the first reliable information was obtained there was a small fistula through which milk could be seen at times to pass shortly after it had been swallowed. The patient was in the Edinburgh Royal Infirmary on several occasions, and under various physicians, and the unanimous diagnosis seems to have been that of cancer. About a year before the patient's death the opening began to enlarge, and when seen would admit the tip of the little finger. The skin surrounding the wound was entirely destroyed, it had been digested, and fluid flowed from the fistula almost as soon as swallowed. This digestion of the skin was checked by the local use of bicarbonate of soda. The opening enlarged, and the patient eventually died of starvation. At the *post mortem* examination it was found that the stomach was closely adherent to the parietal wall round the fistulous opening, which was as large as a shilling, and there was no evidence of cancer. The case would have been a suitable one for an operation on the stomach—that of gastrorraphy.

To avoid the risk of escape of gastric fluid, modifications of the old operation have been devised, the principle being to bring more of the stomach into the wound than is usual, and thus make the opening at the end of a pucker or funnel. The most satisfactory way of doing this is that described by Witzer.

A large amount of stomach is drawn out of the wound and is packed round with gauze. A small incision about a quarter

of an inch in length is made into the stomach near the lesser curvature, and a rubber drainage tube thick enough to completely fill the opening is passed into it. A canal about two inches in length is then made round the tube, whose lining will consist of the peritoneal surface of the stomach. This canal is made by drawing the stomach wall over the tube, and stitching together the folds thus brought up. The excess of stomach is returned into the abdomen and is stitched to the parietal wall as usual. The tube is changed once every four or six weeks.

Gastrorraphy.

The next operation to be considered is that of closing an opening in the wall of the stomach; this may be called gastrorraphy. It may be necessary to perform it for gastric fistula, for gastric ulcer, or for penetrating wounds of the viscus. This operation will never be frequently performed, for gastric fistula is extremely rare, and it will not be often that one will have an opportunity of operating for gastric ulcer, or for penetrating wounds.

This operation is the most simple of any performed on the stomach. Shortly before the anæsthetic is administered the stomach is to be well washed out with a warm solution of bicarbonate of soda, two drachms to the pint. The length of the incision will depend on the thickness of the abdominal wall, and will probably not be more than three inches. The direction of the wound will vary with the position of the fistula, and must be made in the most convenient situation, without any regard to the usual direction of the abdominal wound in stomach operations. The peritoneum is opened at one side of the fistula, and with the finger in the abdominal cavity as a guide, the incision is prolonged round both sides of the skin opening, and also in the opposite direction to the first part of the wound, so as to make the fistula the centre of the incision. If there be much adhesion, it may be broken

down before the incision is made entirely through the abdominal wall. The stomach is thus rendered completely free, and several small sponges are packed into the abdominal cavity, in case any gastric fluid should escape during the stitching. The edges of the opening into the stomach are next to be pared, as small a quantity of the wall being excised as is consistent with removing all cicatricial tissue, and making the opening into a long-shaped oval. Various methods of stitching have been employed in bringing together wounds of the stomach, and also of the intestine; the exact details of these different ways are not of extreme importance so long as the general principle of bringing two peritoneal surfaces into apposition is clearly understood and carried out. There must be no doubt about this. A wound of the stomach or bowel must be brought together in a totally different way from a cut through the skin; the peritoneal edges must be doubled in, for otherwise there is not likely to be union.

For a wound of this kind in the stomach a continuous suture is to be recommended. A piece of fine silk, which has been thoroughly purified, is to be threaded on an ordinary sewing-needle thick enough to allow the double thread at the eye to pass through the tissues without bruising. The stitching is begun at least a quarter of an inch beyond one end of the opening, and particular care is taken to avoid the inclusion of the mucous membrane. The first stitch makes a pucker of the peritoneum, and is tied. The peritoneum is then picked up on one side, and a little nearer the cut on the other, to make the second stitch; the next will probably begin to draw the cut edges together, the needle being inserted about a quarter of an inch or rather less from the cut edge, and brought out nearly at the edge on one side; on the other side the direction is reversed, the needle is inserted close to the edge, and brought out a quarter of an inch away from it. This is in principle, though not actually, the Lembert mode of stitching. It then zigzags in this way across the whole length of the wound, and

finishes as it began, a quarter of an inch beyond the end of the opening. Somewhere about eight stitches are required to the inch; the peritoneal surfaces are drawn together as the stitching is gone on with, and every care must be taken against drawing the surfaces too tightly together. Additional stitches

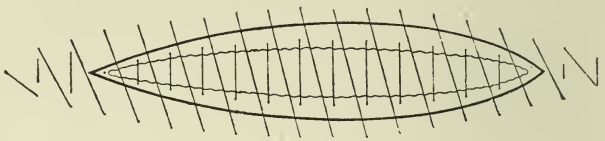

Fig. 15.—Continuous Suture of Stomach.

may be required if there seem to be any weakness at any point; these may be interrupted ones, and are also passed so as to double in the peritoneum; or a second doubling in of the peritoneum may be effected by another continuous row of stitches. Some prefer to use the interrupted sutures entirely; the principle is exactly the same, the peritoneum being turned

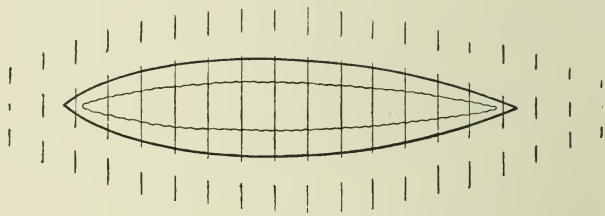

Fig. 16.—Interrupted Suture of Stomach.

in, and the mucous membrane excluded from the loop. A large number of the sewing-needles must be threaded beforehand to avoid waste of time. At each end of the wound or opening a couple of sutures are introduced beyond the ends of the cut to commence the turning in of the peritoneum.

If the opening be a short one a stitch should be put in at the middle, so as to be more certain that the sides come accurately together; if the opening be large other stitches may be passed through the centre of each half. The needle is introduced a quarter of an inch or so from the wound, and is

brought out close to the edge on the same side; on the other side it enters close to the edge and comes out a quarter of an inch or so away from it; the interrupted method of suturing does not therefore differ in principle from the continuous. All stitches are introduced before any are tied. When they have been secured an additional row of stitches may appear to be necessary.

The sponges are withdrawn from the abdominal cavity, and the parietal wall is closed. No fluid or food of any description should be introduced into the stomach soon after the operation; the strength of the patient can be easily kept up for four or five days by the use of enemata, and by that time the wound in the stomach wall will be firmly united. A small cupful of tea may be given on the fourth or fifth day, to be followed by the same quantity of milk, chicken soup, or well-boiled thin gruel; and whatever food is given should be peptonised for the next fortnight, the nutrient enemata being continued if required once or twice a day. The bowels should be moved by injection for the first fortnight.

It might be possible to close successfully a rupture of the stomach caused by a gastric ulcer. It cannot be expected that such an operation will ever be frequently performed; but it might be justifiable in a case where a patient has been known to suffer from dyspeptic symptoms, with limited or localised pain in the region of the stomach, with perhaps attacks of hæmatemesis, and followed by sudden and severe abdominal pain and collapse. A gastric ulcer may, however, cause rupture of the stomach without any previous symptoms. The most common seat of an ulcer in the stomach is near the lesser curvature, more usually towards the pyloric than the cardiac orifice; but it may be found either in the anterior or posterior wall, and, from the operation point of view, the former situation is much more satisfactory, though not so common. The same incision will be used as for gastrostomy, and if the opening in the stomach be not easily found the external wound must be enlarged. When the

ulceration has been on the anterior surface, the contents of the stomach will have passed into the general peritoneal cavity. They must be soaked up at at once, and as soon as the opening has been found and temporarily closed with the finger and thumb to prevent the escape of more fluid, the abdominal cavity is to be thoroughly washed out with warm water. The opening in the stomach is enlarged, if necessary, to show the size of the ulcer and the amount of stomach wall which it will be necessary to remove. This must be done in the transverse axis of the organ, so that the wound when closed will be in the same direction. In a case such as this, where the patient is collapsed, the rapidity with which the continuous suture can be introduced will be likely to add much to the success of the operation. The abdomen is again washed out, if there be any fear that this has not been thoroughly done, and the cavity is made dry before the parietal wound is closed. When no extravasation of food is to be seen on opening the peritoneal cavity the anterior layer of the omentum must be divided, and this should be done rather towards the right side on account of the more usual situation of the ulceration. Should the stomach contents be now seen, it is evident that the ulcer has penetrated through the posterior surface of the stomach, and the opening into the omentum is to be enlarged by tearing. The posterior surface of the viscus can now be reached, and the opening must be searched for. When it is found, and with care this can, in all probability, be done in every case, the opening is to be closed after the contents of the stomach in the lesser peritoneal cavity have been sponged up.

Stitching may be extremely difficult, it may indeed be impossible on the living subject. In such a case it has been suggested that the stomach might be opened in front, and the posterior opening be closed from the inside, the anterior opening being afterwards closed as usual. This procedure would at least give the patient a chance of recovery. Washing out the peritoneum with warm water must be carried out in every case. In regard to penetrating wounds, nothing need be said beyond

what has gone before, except that the operation will be of the nature of an exploratory one, unless food is found to be passing through the external wound.

Gastrotomy.

The third operation on the stomach is that of gastrotomy; this signifies the opening of the stomach itself, and not simply the incision of the abdominal wall.

It is performed for the removal of foreign bodies from the stomach, from the lower part of the œsophagus, and as a preliminary to the stretching of the pylorus, or the lower end of the œsophagus. For practical purposes it may be taken that the cardiac and pyloric openings of the stomach are of equal size, and that a substance that can pass into the stomach can also pass out of it. One reservation must be made, however: it is this, that a long rigid article, as a fork or spoon, may get into the stomach and not be able to pass out; or such a thing as a set of teeth, when it has hooks, may pass the œsophagus and become caught at the pylorus. To avoid this latter accident, when such a set of teeth has been swallowed, a reel of white cotton may be taken, and the whole thickness of the thread divided transversely to its axis, so as to form numerous short lengths. These threads are mixed up with pudding or gruel, or some such food, and swallowed; the threads wind themselves round the teeth and cover the hooks.

Two cases are on record where a solid cake of hair has been removed from the stomach; in one the mass weighed 2 lbs., and the patient confessed that she had been in the habit of eating the combings from her hair. These had become matted together into a solid mass by the help of thick viscid mucus. There is a considerable risk in leaving a foreign body in the stomach; if it be long there, it must of necessity press against the interior of the organ as it contracts, and ulceration is likely to follow, if the patient do not die in the meantime of the dis-

tressing symptoms which arise. At first the patient feels sick, and there is a constant feeling of distress in the epigastrium; then follows pain, worse at one time than at others, and not referred to one spot, but more or less general, over the upper part of the abdomen, or in the bowels. Movements increase the pain, or may bring on a paroxysm; the patient avoids deep breathing, the downward movement of the diaphragm pressing on the stomach. There is loss of appetite, with general dyspeptic symptoms, though the taking of food often gives relief for the time. All these symptoms become aggravated as time goes on, and eventually the general health breaks down. The patient becomes pinched and thin; there is vomiting, which often sets up terrible paroxysms of pain; there may be blood in the vomit and at last the patient dies in great agony of starvation. Symptoms ought not to be allowed to go on so far, when there is a history of something having been swallowed, or when a swelling can be felt in the region of the stomach; and when the symptoms are evidently not due to malignant disease, gastrotomy ought to be performed. One occasionally meets with hysterical women, who give a history of having swallowed a foreign body, but in such cases the symptoms are not likely to be so severe as to make one believe the story. The irritation of the foreign body may give rise to inflammation, and to the formation of adhesions between the stomach and the parietes, or other viscus, and the substance may be extruded through a fistulous opening: should the opening be, unfortunately, not a fistula, death will very quickly ensue.

With the idea of facilitating the performance of the operation it has been suggested that the stomach be distended, and this has been carried out by different means and in various ways. The most simple and safe way would be to distend the stomach with hydrogen gas; other plans, such as distension with ether vapour, or by pouring into the stomach a solution of bicarbonate of soda, followed by one of tartaric acid, have been suggested and carried out. The advantages of distending the stomach are extremely

small, and consist practically in bringing the viscus up to the abdominal wound, while the disadvantages are considerable: the contents of the stomach, unless they consist of hydrogen gas alone, may injure the peritoneum; and in any case the procedure is disagreeable to the patient, unless done after he is anæsthetised, it being easy to pass a tube through the nostril when the patient is unconscious. A disadvantage of distension is said to be that it is more difficult to reach the foreign body, but as the stomach will empty itself as soon as it is opened, this need not be considered. The best plan is simply to wash out the stomach before the anæsthetic is given with a solution of bicarbonate of soda, which must be all carefully withdrawn, as the retention of any fluid is likely to give rise to vomiting. The incision parallel to the costal margin on the left side is the most convenient. The stomach is reached in the way already described, it is drawn forward into the wound, and before it is opened, sponges are carefully packed all round to protect the peritoneal cavity. With the stomach contracted, there is not likely to be much difficulty in feeling the foreign body, and great care must be used especially if it is known to be sharp. The opening into the stomach is made in a transverse direction, and at the spot which seems most convenient for the extraction of the fork or whatever object may be present. The point of opening having been fixed upon, the stomach is grasped on one side by the finger and thumb of the operator, and on the other side by the assistant, and the coats are divided by scissors. The peritoneal edges of the wound are fixed by the pedicle forceps, and the wound is thus kept forward by the assistant. The finger is introduced to make sure that the foreign body has not become attached in any way, and to guide the forceps in its extraction. After it has been removed the stomach does not require to be sponged out unless there be any indication for doing so, as it is better to avoid interfering with an already much irritated mucous surface. If the sponges have got wet they are now to be removed, and dry ones again put into the

peritoneal cavity. The opening into the stomach is closed in the manner described in the previous operation of gastrorraphy; the sponges are removed, and the parietal wound is closed as usual, a drainage tube not being required. The after treatment has already been described.

When a foreign body has become fixed in the lower part of the œsophagus, and has resisted every attempt to push it onwards with bougies, and where the block appears to be too low down for a successful result by opening the œsophagus, the only thing which can be done is to attempt to clear away the obstruction by operating through the stomach. The operation has been such a rare one that we cannot do better than reproduce Dr. Richardson's account of the first successful case.

"The patient, a man aged thirty-seven, tall and strong, weighing when in health from 160 lbs. to 180 lbs., had swallowed, while eating, a denture of four teeth. The teeth were lodged near the cardiac end of the œsophagus. He was admitted to the hospital, and numerous attempts were made to dislodge them. At one time sufficient traction was used to break the coin probang which had been made fast to the plate. He was finally discharged from the hospital, having gained in weight, and it was thought the foreign body had passed into the stomach. Eleven months after the accident the man came again to the hospital, and the foreign body was found to be in the same place as before, fourteen inches from the central incisors. The patient was reduced to 113 lbs. in weight. He had continual pain, and it was with great difficulty that he was able to swallow enough liquid food to keep him alive. There were two methods of procedure possible, all attempts at removal through the mouth having failed: one by external œsophagotomy, in the manner described by Dr. Leroy Maclean of Troy, and so successfully performed by him; and the other through the abdominal wall and stomach. I selected the latter method because it had been shown that the plate was very firmly impacted indeed, and that it was very probable that

it would be necessary to use the fingers in dislodging it. For two days before the operation the patient was nourished by enemata, and nothing was taken into the stomach but water and stimulants. After etherisation a cut was made parallel to the lower margin of the ribs on the left side, six inches in length, through which the stomach was drawn and held on aseptic towels by assistants. A small opening through the stomach wall was next made midway between the curvatures, and forceps introduced for the purpose of grasping the plates. The cardiac opening could not be found. The cut was then enlarged enough to admit the right hand, which was introduced until the œsophageal opening was found. The foreign body was detected by the fingers about two inches above the diaphragm; after considerable manipulation with the index and middle fingers the plate was detached and removed. The mucous membrane of the stomach was closed with a continuous silk suture, after the method of Lembert. The patient made a good recovery."

Location of the foreign body (or condition requiring operation).—If it is known how far the obstruction is from the central incisors when the head is thrown back, in the position for passing the exploring probang, and if the distance from the same point to the cardiac opening is determined, it is evident that we can tell immediately whether the obstruction can be reached from below or not. If the individual is of average height, and with a neck of ordinary length, it is safe to say that the distance from the central incisors to the diaphragm is about fourteen inches and a half. If the probang is arrested at a point more than thirteen inches from the incisors, the point of obstruction is probably at or near the cardiac end of the œsophagus. In all subjects examined this fact was observed; in some of them it was quite difficult to reach every part, but it was nevertheless possible. The method of making these observations was to do first an external œsophagotomy in the usual way. Then the stomach was opened and the fingers of the left hand introduced into the cardiac opening. With the forefinger of the

right hand in the upper wound and the forefinger and middle finger of the left hand in the lower end of the œsophagus, it was found possible not only to make the fingers touch, but in many cases to make them overlap quite a distance; coins and other bodies were passed from one hand to the other with great ease.

It cannot be denied that these conditions of observation cannot be reproduced on the living subject, and that the results are only approximate. It would be hardly practicable to do both operations on the same patient. If both hands are in use, pushing towards each other, it is of course much easier to bring the fingers together and to push the foreign body from one finger to the other waiting to receive it.

Yet even in the living I think it is safe to say that there is no point in the œsophagus that cannot be reached by the finger, either from above or below. The other source of error is in the fact that in the cadaver the diaphragm is relaxed. This does not make any appreciable difference, however, because the opening in the diaphragm is so fixed to the bodies of the vertebræ that it does not share to any extent in the contraction of that muscle. It is possible to reach with the left hand three inches above the cardiac opening, that is to say, the length of the left middle finger. From above, through the wound in the neck, one cannot reach quite so far on account of the sternum and clavicle. One can, however, easily reach the arch of the aorta, and even hook the finger round it in some cases. In a few of the dissections the measurement was made between the centre of the incision in the neck to the diaphragm. The distance was a little over six inches. Allowing in the average neck an inch and a half to two inches from the cricoid cartilage to the lower point of the incision in the œsophagus, in external œsophagotomy we have the average distance from that incision to the cardiac opening of five and a half to six inches. The general conclusion at which I have arrived from these measurements and digital explorations is that the obstruction can be

reached by the finger in all or nearly all cases where it is situated more than six inches below the cricoid cartilage. If less than six inches below the cricoid ring, it can be reached best from above, though in some few cases it may be just beyond the reach of the finger. Even in these cases instruments can be easily and intelligently applied. The measurements of the point of inspection or obstruction having been carefully made, and it having been demonstrated that the point in the œsophagus to be reached if necessary by the finger is not less than thirteen inches from the upper incisors and six from the cricoid cartilage, the operation of gastrotomy should be performed.

Inasmuch as the best argument in favour of gastrotomy is that the fingers may be used to detach the foreign body, if all other means fail, it is evident that the probability of the introduction of the hand into the stomach is the most important element in the selection of the incision through the abdominal wall. In the case of the patient on whom I have done this operation it seemed to me best to make an oblique incision under the margin of the ribs on the left side, directly over the stomach. By this incision the stomach can be recognised very easily and drawn out of the wound so far that the subsequent manipulations can be made without the escape of the contents into the peritoneal cavity. From a large number of dissections for the purpose of deciding the question of the incision in the abdominal wall, I have come to the conclusion that the oblique cut is the best on the whole for this operation, although fingers can be introduced into the œsophagus with ease after making the median cut. The incision through the walls of the stomach for the purpose of introducing instruments into the cardiac end of the œsophagus may be made anywhere, provided that it is far enough to the right to avoid the convexity of the lesser curvature. All that is necessary is to put the lesser curvature on the stretch, so that it make a straight line to the diaphragmatic opening. The cut through the stomach wall must be far enough to the right to allow the passage of the instrument along

the sulcus between the anterior and posterior walls of the stomach, made tense as above. If the instrument is brought obliquely to this groove and passed upwards, all the time being pressed gently against the straightened lesser curvature, it will glide into the œsophagus every time with the greatest ease.

The stomach having been exposed by the lateral cut through the abdominal walls, and having been drawn out of the wound, it must be held by an assistant in such a way that the lesser curvature is put on the stretch. It is better for the assistant to hold the stomach in both hands, so that the whole viscus is flattened out. He should stand on the left of the patient, and grasp the greater curvature. The operator standing on the right of the patient, holds the lesser curvature between the left thumb and forefinger, thereby making tense the lesser curvature and assisting in the passage of the instrument. Before doing this it is best to introduce the hand into the peritoneal cavity and examine the diaphragmatic opening externally. With the stomach held as described, the opening in its wall may be made anywhere in its flattened surface so as to avoid the large vessels. It goes without saying that the incisions should first be just large enough to get hold of the stomach with the thumb and fingers and draw it out so as to stretch the lesser curvature. An incision through the stomach wall can then be made large enough to introduce the instrument, by which, I believe, the foreign body can be removed with ease in the majority of cases.

In the selection of the operation, whether by external œsophagotomy or by gastrotomy, another reason for the choice of the latter operation is that there is less danger of wounding important structures in the thorax, when the traction is downwards than upwards. If the body is at the orifice it is not in direct relation with pleura, heart, or aorta. There is much less danger of lacerating the œsophageal wall in pulling down the foreign body a short distance than pulling it up a considerable one.

In November 1893 Mr. Wallace showed a patient at the Edinburgh Medico-Chirurgical Society, upon whom the combined operation of external œsophagotomy and gastrotomy had been performed. The following is the account of the case :—

"The patient was admitted to Ward 14 of the Royal Infirmary on 31st July 1893, and stated that seventeen hours previously a plate with five teeth had passed into the gullet. The plate was caught with a coin catcher, but could not be dislodged. An endeavour was made to remove it through an opening in the œsophagus made as low down in the neck as possible, but although it could be caught with dressing forceps it remained immovably fixed a little way above the cardiac opening. This endeavour having failed, Mr. Wallace at once performed gastrotomy—passed his hand into the stomach, and, having introduced his finger into the œsophagus, grasped the plate with a pair of dressing forceps and readily withdrew it. The stomach wound, 4 inches long, was then stitched (Czerny-Lembert) and the abdomen closed. The whole procedure occupied two hours. The patient made an excellent recovery, and left hospital six weeks after admission. She states (1st November 1893) that she is in perfect health. The wounds are firmly and completely cicatrised."

There may be a stricture either at the entrance or exit of the stomach, and the artificial dilatation of either of these by operation is known by the name of Loreta's operation. Simple stricture of the lower end of the œsophagus has already been discussed.

When there is a narrowing of the pyloric orifice there will be found more or less thickening, due to hypertrophy of the muscular tissue, which is often so great that a distinct tumour can be felt on abdominal examination. The symptoms caused by this condition resemble to a certain degree those of cancer of the pylorus, but the great point of difference is the length of time the former may exist in comparison with the latter.

What is first noticed is dyspepsia, then dilatation of the stomach, and vomiting. Unless the contraction has existed for a long time, the patient is hungry immediately after he has been sick, showing that there has not been much interference with the glands of the stomach. Examination of the contents of the stomach gives, chemically, an acid reaction, with no trace of albumen or peptones; microscopically, the results are negative.

Gastrectomy.

This operation, which signifies the removal of part of the stomach wall, is one which can only be performed under very exceptional circumstances. Any tumour connected with the stomach, and which can be felt from the outside, will be of such a size that its removal would entail the excision of the greater part of the organ. The diagnosis of the presence of a tumour connected with the stomach wall which cannot be felt through the parietes can never be made with certainty, and it is doubtful if this operation ought to be recognised as a legitimate one.

Gastro-Enterostomy and Pylorectomy.

The latter offers the possible hope of a cure, the former is only to give relief, the pylorus being put completely at rest by making an artificial channel for the passage of food from the stomach into the intestine. It is difficult to say what ought to be the proper mortality following the operation of removal of the pylorus, but under the best of circumstances it cannot be small. The death rate of the alternative operation ought to be very much less. If it be ever right and proper to perform either of these operations the one fixed on ought to be that of gastro-enterostomy; but it should be arranged with the patient that, if there be no secondary deposit and if it be possible to remove the whole of the disease, pylorectomy will be performed.

This is the better plan, for one can never know whether there be any secondary deposit or not until the fingers are inside the abdomen. The operation ought therefore to be begun only with the intention of relieving the patient of suffering, for the mortality is too high, and the chances of return too great, to justify the performance of a pylorectomy except under the most favourable circumstances. Of those who are fortunate enough to recover from the removal of the pylorus, it seems that the time they may hope to keep free from the disease is about three years. A large proportion of those who do not survive the operation die of shock, due doubtless to interference with the sympathetic, and to the long time which usually appears to be spent over its performance.

The symptoms of cancer of the pylorus, other than the general constitutional symptoms of malignant disease, are somewhat similar to those of fibrous contraction, but they come on more rapidly and are much more acute. There is first a feeling of discomfort; then dyspepsia; loss of appetite; derangement of the bowels; dilatation of the stomach; vomiting—the matter voided being sometimes mixed with blood, and showing evidence on microscopic examination of the presence of malignant disease. Pain is as a rule very severe in the situation of the pylorus, and a definite tumour is usually to be felt.

Gastro-Enterostomy.

The incision is made in a transverse direction over the swelling, though the operation has also been performed through a median longitudinal one. The stomach, having been washed out as usual, is to be fixed to the highest part of the small intestine which can be brought easily against it. This will be the upper part of the jejunum, and it may be brought in contact with the stomach, either by taking it round the omentum, which seems to be the best plan; or the omentum may be turned up with the transverse colon, and the posterior part of

the stomach attached, probably to the duodenum; or an opening may be made in the omentum for the passage of the gut. The second plan seems to be a very difficult one, and the last appears to add the unnecessary danger of obstruction. The part of the intestine fixed on, and the stomach about the centre of the anterior wall, are drawn up to the wound. Well warmed sponges, as is recommended in all abdominal operations, are packed into the cavity to prevent any of the contents of the stomach or intestine from reaching the peritoneum. The stomach and intestine are to be attached to each other, either by Senn's decalcified perforated bone plates or by stitches. The former method appears to be undoubtedly the better one. By using the bone plates the time taken in the operation is very much reduced, and there does not seem to be any chance of a leak occurring. We shall describe first how the stitches are put in, and then return to the preparation and mode of use of the bone plates. A constrictor is to be placed on the small intestine a couple of inches above, and one the same distance below the point fixed on for opening. This may be done with clamp forceps, or preferably by passing bands of indiarubber through the mesentery, and fixing them with catch forceps instead of tying, just so much pressure being used as will prevent escape of the contents of the bowel and no more. An incision is then made into the gut one and a half inch in length, in the longitudinal direction, opposite to its mesenteric attachment, and any contents remaining in that part of the intestine are to be emptied out. An incision of similar length is made into the stomach, and in the direction which seems the most suitable. The edges of the openings in the stomach and intestine are then brought together by several continuous silk sutures; several interrupted ones, say four to the inch, being placed beyond to give support. It has been suggested, and the plan has been carried out, that the peritoneal and muscular coats of the stomach and intestine should be divided first, thus allowing of the suturing of the posterior part before the hollow viscera are opened. The rubber ligatures are

removed as soon as the stitching is completed, the sponges are taken out, and the wound is closed.

When the decalcified bone plates are used the steps of the operation will be the same until the incisions into the stomach and bowel have been made. These will require to be rather longer, as it is desirable to use large bone plates, and the edges must not be bruised by forcing them through too small an opening. Before placing them in position, the four silk threads attached to the ends and sides must be threaded on to round sewing-needles, and as soon as the plates have been introduced, the needles transfix all the coats of the stomach and intestine, passing from the mucous to the peritoneal surface. There are, however, eight threads, four from each plate, to be tied together, and before this is done the peritoneal surfaces which are to be brought into apposition are slightly scarified with the point of a needle. The threads are then tied, each lateral one from one plate to the corresponding lateral one of the other plate; and so also with the end ones. The threads are cut quite short. Senn has proved by experiment that two parts of the intestinal tract joined together in this way will stand a pressure of 2 lbs. to the square inch, and this far exceeds anything which could result from intestinal distension. The bone plates break up, and in about ten days are passed per anum, usually in fragments, but long before this happens the two pieces of bowel will have become firmly united. Various modifications of the bone plates have been made, but Senn's appear to be still the best.

The directions for preparing the decalcified bone plates are as follows: "The compact layer of an ox's femur or tibia is cut with a fine saw into oval plates one-fourth of an inch in thickness, two and a half to three inches in length, and an inch in width. The plates are then decalcified in a 10 per cent. solution of hydrochloric acid, changed every twenty-four hours until they have become sufficiently soft so that they can be bent in any direction without fracturing. After decalcification they are washed by letting water flow over them from three to six hours

so as to remove the acid. The plates are then covered with porous paper, and compressed between two pieces of tin until they are perfectly dry. If, during the process of drying, the plates are not compressed between two smooth surfaces they become distorted by warping. The hardened plates are then drilled several times in a straight line in the centre, and the openings enlarged and connected with a file, until the perforation is five-eighths of an inch in length and about one-eighth to one-sixth of an inch in width. The sharp margins of the plate and perforations are removed with a file. With a fine drill the four perforations for the sutures are made near the margin of the oblong perforation, one at each end and one at each side. For preservation the plates are kept in absolute alcohol. When the plates are to be used they are washed in a 2 per cent. carbolic acid solution, and the threads or sutures attached by threading two fine sewing-needles, each with a piece of aseptic silk twenty-four inches in length, which are tied together. The threads are then fastened to the surface of the plate by another thread passing through the perforations in the shape of a loop and fastened at the back."

Pylorectomy.

The stomach is washed out, and the incision is usually made in a transverse direction over the pylorus, and is supplemented, if necessary, by a second one at right angles. When so much muscle is cut through, as must happen when an incision is made in this direction, the bleeding is certain to be free, and it is better to tie the bleeding points at once with fine catgut than to leave on forceps. As soon as the peritoneum is opened the exact condition of the disease is examined, and if it seem possible to remove the whole of the growth the operation is continued. The pylorus, which will be found to be situated lower in the abdomen than usual, is drawn upwards towards the wound, and the exact shape and situation of the disease is

carefully examined so as to indicate where the large and small omentum are to be divided. The large is first cut through to as short a distance as possible, and then the small one is divided, bleeding vessels being tied with catgut. Any adventitious adhesions are now separated, and when this has been done, sponges are packed in all round and below the part to be removed. The exact position of the incisions in the stomach and duodenum will depend on the size of the growth. The stomach is first cut through with scissors, delicate forceps being put on all bleeding vessels. As soon as the first cut is made, fluid from the stomach should be soaked up with a sponge, which must not be used again. The stomach is kept forward by the right hand of the assistant, who also with his left grasps the duodenum as it is divided, and in this way he can prevent hæmorrhage, until all bleeding points in the wall of the duodenum have been tied with fine catgut. As the opening into the duodenum is smaller than that into the stomach the latter must be reduced in size. The duodenum is fitted in at the greater curvature of the stomach, the remainder of the opening in that viscus, which will be towards the lesser curvature, being closed by a continuous suture. Shock being a frequent cause of death, the time taken in the performance of the operation should be reduced by using the continuous suture, one sufficing for that part of the stomach which is stitched together, and not more than three or four being required for joining the gut together. A little time may be saved by stitching the posterior part from the inside, peritoneal surface of course being opposed to peritoneal surface. A few interrupted sutures may be put in beyond the continuous ones to give support and to take off tension ; these are especially required at the angle where the wound in the stomach meets the circular stitches. The sponges are removed and the wound is closed. The after treatment is the same as after any other operation for closing a wound in the stomach wall.

Instead of stitching together the cut ends of the stomach

and duodenum, the alternative plan of closing the openings and performing the operation of gastro-enterostomy may be adopted. The open end of the duodenum for fully half an inch is invaginated and closed by a continuous silk suture, which brings the peritoneal surfaces together; the divided end of the stomach is treated in the same way, and the continuity of the alimentary canal is made by connecting the stomach and some part of the small intestine together by means of bone plates. On the whole this latter plan is the better, but there is probably not much to choose between the two methods.

Loreta's Operation.

The stomach is washed out as usual before the operation, and the incision recommended by Loreta is made in the middle line, about four inches in length. The stomach is drawn up to the wound, sponges to protect the peritoneal cavity are packed in, and a point is fixed on between the curvatures on the anterior surface of the stomach, which is to be the site of the opening. The incision is made in a transverse direction large enough to admit two fingers, and at least one inch from the thickened pylorus which can be easily felt. Should it appear more convenient the opening may be made farther away, the whole object being to reach the constriction as easily as possible. Forceps are fixed on to the edges of the stomach wound, and after any bleeding points have been ligatured with fine catgut, the forefinger of the right hand is passed into the stomach, and if possible into the stricture. When this is being done the pylorus is steadied by the left hand, which has been passed into the abdominal cavity. The resistance of the contracted pylorus to dilatation is very great, but with continuous pressure the finger can be gradually and steadily pushed through. As soon as this has been done the pylorus can be hooked forwards and steadied by the fingers of the right hand from within, and the left forefinger is passed into the stomach, and is gradually

insinuated alongside the other. When both fingers have been got through, they must be separated so as to dilate the opening thoroughly; Loreta in his first case dilated to the extent of three inches. As soon as all resistance has been overcome, or when the tissues seem as if they might tear, no further dilatation must be attempted; but the opening must not be allowed to contract for some minutes. The incision through the stomach is stitched as usual, the sponges are then removed and the abdominal wound closed. Food is given as after gastrorraphy.

For dilatation of the œsophagus the incision will be made in the stomach where it is most convenient; this will usually be somewhere about the middle of the anterior surface. The opening should be made of sufficient size to allow the entrance of one finger, the stomach being invaginated as it is pushed up to the cardiac orifice. If one finger can be got through, the dilatation may be finished by Loreta's dilator; or this may be used instead of introducing the finger. The extreme amount of dilatation possible by Loreta's instrument is two inches.

Pyloroplasty.

This operation is of use only in cases of simple stricture. It consists in the exposure of the pylorus, and the division of the stricture after the peritoneal cavity has been shut off by sponges. The incision extends from the stomach to the duodenum completely through the stricture. The divided mucous membrane and peritoneum are stitched together all round the opening. The centre of the incision on each side is drawn on so as to alter the direction of the opening. It becomes transverse across the bowel, instead of longitudinal, and it is closed in this direction. This is exactly similar to what is done in the vagina or elsewhere when a cicatricial contraction is divided.

This operation is a more recent one than that of Loreta. It is not more dangerous, and appears to offer a more certain and lasting cure.

Distension of the Stomach.

In a few cases, a greatly distended stomach has been reduced in size. The abdomen is opened in the middle line, and the stomach is made smaller by taking several pleats in it, stitching the peritoneal surfaces together in layers. The result of these operations appears to have been so far satisfactory.

CHAPTER VII.

THE INTESTINE.

The Anatomy and Connections of the Intestine.

The first part of the small intestine—the duodenum—extends from the pyloric opening of the stomach to the left side of the second lumbar vertebra. It measures from ten to twelve inches in length, and differs from the jejunum and ileum in being more fixed in position. It has the curve of a horseshoe with the concavity looking towards the left. It surrounds the head of the pancreas, and lies in front of the right kidney and suprarenal capsule, the vena cava inferior, the right psoas muscle, the right crus of the diaphragm, and the aorta. Its relation to the kidney is subject to considerable variation. The first part of the duodenum extends from the pylorus to the under surface of the liver. The common bile duct, and along with it the pancreatic duct, open into the inner and posterior aspect of the second part of the duodenum a little below its middle. This part extends to the right side of the third lumbar vertebra. The third part like the second is immovably fixed in position and does not possess a mesentery, being only partially covered by peritoneum. The junction of the duodenum with the jejunum is marked by the duodeno-jejunal flexure, which, together with the root of the mesentery, is held in position by a band of involuntary muscular fibres—the suspensory muscle of Treitz. This muscle descends from the right side of the œsophageal

opening in the diaphragm and in front of its left crus to be inserted partly into the duodeno-jejunal flexure and partly into the mesentery.

The exact relations of the peritoneum to the duodenum are as follows: the first part, two inches in length, is invested by the same two layers of peritoneum which enclose the stomach, and it is thus fairly movable; the second or descending portion, about three inches in length, is covered by peritoneum only in front, while the posterior surface has a variable relation to the right kidney, the right suprarenal capsule, and the inferior vena cava, being separated only by some areolar tissue, and therefore completely fixed; the third part, somewhere about five inches in length, is also fixed, being covered by peritoneum on its anterior surface, while the root of the mesentery crosses obliquely downwards from left to right. The superior mesenteric artery and vein also lie in front of this part of the duodenum, the vein being to the right side of the artery.

The division of the rest of the small intestine into jejunum and ileum is a purely arbitrary one, and, with the exception of the two extremities, it has no fixed position, the one end being, as described, over the left crus of the diaphragm, and the other in the lower part of the right lumbar region close to the iliac crest. The jejunum and ileum are attached to the back wall of the abdomen by a double fan-shaped fold of peritoneum forming the mesentery, which extends from the left side of the second lumbar vertebra across the spine to the right sacro-iliac articulation, and contains blood vessels, nerves, lymphatic vessels, glands, and the gut. The commencement of the large intestine, the cæcum, is situated in the right iliac fossa, it is usually entirely surrounded by peritoneum, and is thus somewhat movable. The ileum opens into the cæcum on its inner and posterior aspect two and a half inches above its blind end. The ileo-cæcal valve, which is situated at this point, is an extension of the end of the ileum into the cæcum, and while it allows of easy passage from the small intestine into the large, it

acts as a barrier in the opposite direction when the cæcum is distended.

The vermiform appendix opens into the inner and posterior aspect of the cæcum below the junction of the ileum and cæcum. It consists of a narrow diverticulum from three to six inches in length, and is held in position by a special mesentery. The ascending colon passes upwards as far as the liver. It is usually covered by peritoneum on the front and sides only, leaving a space behind in contact with cellular tissue which separates it from the fascia covering the quadratus lumborum muscle and from the lower end of the right kidney. In some cases a distinct mesocolon is found. The transverse colon runs across the upper part of the abdomen, there being usually a distinct bend downwards. It is attached by a mesocolon, which permits of great freedom of movement. At its right end, the hepatic flexure unites it to the ascending colon, while by means of the splenic flexure it is continuous at its left end with the descending colon, which resembles the ascending in being usually uncovered by peritoneum posteriorly. It descends upon the left kidney and the quadratus lumborum muscle, being separated from them by areolar tissue. At the iliac crest the descending colon becomes continuous with the sigmoid flexure, which extends to the left sacro-iliac articulation, at which point the term rectum is applied to the remainder of the large intestine. The sigmoid flexure possesses a mesentery—the sigmoid mesocolon—which is continued to the upper part of the rectum, where it is termed the meso-rectum.

The blood supply of the bowel is very great, the anastomoses are numerous, and the blood vessels run in the mesentery. The duodenum receives its supply from the branches of the cœliac axis, and from the superior mesenteric artery. The rest of the intestine is supplied by branches from the superior and inferior mesenteric arteries, which also spring from the aorta. All these blood vessels are freely supplied with nerve filaments derived from the solar plexus; and numerous lymphatics are also found

in relation to the mesentery. The veins which return blood from the regions supplied by the branches of the cœliac axis, superior and inferior mesenteric arteries, ultimately coalesce to form the portal vein, which enters the liver at its transverse fissure, along with the terminal branch of the hepatic artery.

When we come to this, the most difficult part, from a diagnostic point of view, of the digestive tract, it is necessary to lay down some general principles and rules to act as a guide in advising what is best for the patient. What we have to attempt to do is to obtain sufficient information from the symptoms shown by the patient; from the history derived from himself and his friends, from the physical examination, and also from his general condition, more especially as regards his strength and the state of the heart and pulse,—which will enable us to come to a correct diagnosis and prognosis. In cases such as we are about to consider, the temperature does not give much information, and we must rely on the general appearance and expression, and, above all, on the condition of the pulse. We can afford to delay operative interference, if we have not been able to arrive at a diagnosis, so long as the pulse keeps of good strength, and where it is not increasing in rapidity, or increasing very slowly, and when the rate is not above, say, 108 or 110. If the pulse rate be coming down, even if there appear to be no improvement in the local condition, it is not right to operate. There is time to wait, for there must be some improvement in the local condition, even though it be not evident to account for the diminished pulse rate. But this does not apply when some treatment, such as washing out the stomach, has been lately carried out. When a diagnosis has been made, and when the chances are against the patient if no operation be performed, there is little to be gained by waiting, and the sooner the operation is performed the better. It would be folly to wait for the pulse to rise. This all leads up to what has been said over and over again, that every effort must be made to come to a correct diagnosis.

The common surgical disease of the intestine is a more or less complete obstruction of the lumen of the gut. If the obstruction be complete, death may be due simply to the block; but death may also occur when there is partial occlusion, due probably to a sudden internal injury, or to acute septic poisoning, or to a combination of these two conditions.

Generally, an acute obstruction may be due to altered conditions of the wall of the bowel, mural obstruction; to an obstruction from the outside, extra-mural obstruction; to an obstruction inside the gut, intra-mural obstruction; or a combination of any of these conditions may occur in the same subject.

Mural obstruction is met with when there is a condition of paresis of the intestine. This may be either primary, or it may be secondary to an attack of peritonitis, or it may follow an abdominal operation. These secondary conditions have been considered elsewhere, and do not require to take up our attention at present.

A second condition of this form of obstruction is that caused by intussusception, that is to say, a doubling in or invagination of the bowel upon itself. This condition may also be divided into two varieties, the acute and the chronic.

Another form of this obstruction, fortunately a rare one, is that known by the name of volvolus, *i.e.* a twisting or rotation of the bowel on itself. Under this heading of mural obstruction congenital deficiency of the lower part of the bowel must be included to make the list complete. This condition is treated of in connection with colotomy.

Extra-mural obstruction is due to a block resulting from the presence of a band either surrounding a knuckle of intestine or under which a coil of bowel has passed, an adhesion of the bowel at an angle, or the passage of part of the intestine through an opening such as the foramen of Winslow, the obturator foramen, or an opening in the mesentery or omentum. These comprise the extra-mural causes if we exclude the ordinary

herniæ which by long use are considered to belong to the works on general surgery.

Intra-mural obstruction is caused by a gall-stone, or by an enterolith, which is a concretion formed by a secretion of the intestine.

Combinations of any of these acute conditions, or the combination of an acute with a chronic condition, must be borne in mind, so that, when one obstruction has been discovered and dealt with, others may have to be looked for.

Obstruction due to Nervous Exhaustion.

This is a condition which has been much overlooked. It consists, at first, in severe cases, of a greatly excited action of the bowels, followed by complete paralysis, and death occurs in from three to four days unless the intestine recover its nerve tone. This condition ought hardly to be classified as an obstruction; there is no diminution of the lumen of the gut at any point, but there is a relaxation, and even an increase in size, with complete loss of power in the muscular tissue to pass on the contents of the bowels. In this way it practically comes to be an obstruction, and the symptoms are very much those that are found when there is diminution in the lumen at some part of the intestinal tract.

History and Symptoms.—The condition is much more common in men than in women, and occurs most frequently in robust patients. In the milder forms it is by no means uncommon, and it is rare to find that life is seriously endangered by this condition of the bowel.

The history of an extreme case is, that a man who has led a more or less sedentary life for some time, suddenly and without preparation undergoes great fatigue. He becomes very hungry and eats a large meal, perhaps in the open air. Within a few hours, at latest twelve, he is attacked by severe abdominal pain of a colicky nature, often accompanied by vomiting. In-

testinal movements are distinctly heard. At the very commencement a little flatus may be passed, soon this entirely ceases, and within a very few hours the pain has abated and the abdomen has begun to distend. This is quickly followed by return of the vomiting, which had ceased for a time, and its character has now changed. At first it was accompanied by much retching, now the vomited matter comes up with little effort. The extremities become cold, the face is pinched and anxious, and nothing has passed from the rectum. By this time the pulse has become rapid, from 120 to 160, the abdomen is greatly distended, and the patient dies of heart failure.

A stout, somewhat florid American, aged forty-two, the proprietor of a large cattle ranch, and who as a rule took little exercise, started off before the mid-day dinner to assist at the extinction of a prairie fire some miles away from his house. During the whole of the afternoon he was hard at work beating down the flames with wet sacks. He rode home after sunset, and being very hungry, having had nothing to eat since early breakfast, he ate a large supper, consisting chiefly of cabbage and pork. Four or five hours after, he was awakened out of his sleep by an attack of intense colic, accompanied by vomiting. He took a large dose of laudanum, and as the pain did not abate he had a warm bath, and his wife rubbed laudanum on his abdomen. The pain was entirely relieved by this treatment, but in the morning the abdomen was seen to be much distended, and the vomiting had returned. The pulse was rapid, and within thirty-six hours from the commencement of the attack the patient was dead, no other treatment having been tried. A *post mortem* examination was made, but nothing was found except general distension of the bowels.

Treatment.—The treatment consists in preventing loss of strength by keeping the patient warm and quiet in bed, and the complete stoppage of food and fluids of all kinds by the mouth. The special treatment is directed to the early arrest of the peristaltic action, and to the soothing of the excited sympathetic.

The bowel, in an exhausted subject, has been irritated by the presence of a large quantity of food, it appears to resent this, and to be working in an irregular, excited, and useless manner to get rid of the irritation.

A fairly large dose of morphia is to be injected hypodermically to stop quickly the peristalsis which is going on, and a quarter of a grain must be given, if, as is usual, the patient is a big heavy man. If the pain and intestinal movement do not soon cease a further dose is to be administered. Some four or five hours after complete rest has been given in this way, a large dose, at least an ounce, of castor-oil is to be taken, and, if the bowels can be got to move, the patient is practically well. Should the case not be seen until the bowel has become paralysed and relaxed, the treatment will have to be somewhat different. Only a sufficiently large dose of morphia is given to keep the patient quiet and at rest, not more than one-sixth of a grain, and the stomach is emptied either by a soda vomit or by washing out. The object is to give the bowel rest, and to allow of the recuperation of the nervous system; while, by emptying the stomach, vomiting is relieved for a time, and there is not so much pressure on the heart. Unfortunately, one cannot afford to wait long, and a short rest must sometimes suffice, but if the general condition be not getting worse, and the distension of the stomach be not increasing rapidly, it is better to wait for four or five hours, and then to give the mixture of magnesia and peppermint by the mouth—℞ magnes. sulph. ʒi.; magnes. carb. grs. x.; aq. menth. pip. ʒss. This medicine is more likely to be retained than castor-oil, and the dose is to be repeated if the first should be brought back. Quinine is also to be injected into the rectum, as described under After Treatment in Chapter IV. Here, and also whenever there is any abdominal distension, the rectal tube must be frequently used.

In all these cases, one-hundredth of a grain of strychnia is to be injected hypodermically every two hours.

A gentleman, age twenty-five, had travelled from London to

Perthshire during the night, arriving on the morning of the 12th of August, which was a Tuesday. He went out shooting at once, ate a heavy lunch, and during the afternoon, while still on the moors, was seized by severe abdominal pain. He became unable to walk, and had to be carried home and put to bed. The pain diminished, the abdomen began to distend, and vomiting became constant. Two days afterwards, on the Thursday, the vomit became stercoraceous, and Dr. Keith was telegraphed for to come prepared to open the abdomen. When he arrived on Friday the patient appeared to be within a few hours of death, he was constantly vomiting fæcal matter, no flatus had passed, the hands and feet were cold and blue, and there was much general distension. The treatment consisted in covering the abdomen all over with a large poultice, surrounding the patient with hot bottles, and the administration of a quarter of a grain of morphia hypodermically, followed about five hours after by a dose of castor-oil. The general appearance quickly improved, there was no more vomiting, and during the next day a small quantity of flatus passed several times. In the afternoon another dose of morphia was given, followed by a dose of castor-oil in the evening. During the night the bowels moved very freely, and there was no further trouble.

In all cases of simple paralysis of the intestine any operative interference is quite useless, and can only lead to disappointment. Should one be so unfortunate as to open the abdomen in one of these cases, no attempt should be made to remove the contents of the bowel, either by incising or by puncturing with hollow needles, for the less the intestine is interfered with the more chance there is that it will recover its tone.

Intussusception.

Although this is the most common cause of intestinal obstruction, it resembles the condition previously described in that there is not necessarily any actual block in the lumen of

the gut. What happens in a case of intussusception is, that one part of the bowel is doubled in or invaginated into the bowel immediately below it, so that if a probe were passed downwards through the invagination no obstruction would be met with; if, however, the probe were passed upwards, unless it should chance to hit the centre of the invagination, it would be arrested where the bowel commences to double in, and it would have to be drawn downwards before it could be passed up to the original starting-point. This condition is found more frequently in the small than in the large intestine, the favourite points being in the one at the ileo-cæcal valve, and in the other about the rectum. The relative frequency of the position of this diseased state is, roughly speaking, something like the following. At the ileo-cæcal junction a bare half, in the ileum a good quarter, in the colon about one-fifth, and the ileo-colic about half that number. This condition is more common in children below the age of ten or twelve than it is during the whole of the remainder of life. It is very frequently met with during infancy, and in the young it is usually acute; after the age of twenty it is, as a rule, chronic.

Causes of Intussusception.

Intussusception is caused by the irritation of a diarrhœa; by ulceration of the mucous membrane, as after typhoid fever and dysentery; by the pressure of a tumour attached to the inner surface of the bowel dragging its connection downwards into the bowel below; and by the irritation caused by the presence of worms. All of these conditions are frequently associated with a chill. In some cases it is difficult, or it may be impossible, to assign a cause for this doubling in of the bowel. As the bowel becomes invaginated the veins running in the mesentery are drawn on and constricted, and the result is the same as is seen in a strangulated hernia. The blood passes more freely into the invaginated portion, the intussusceptum, than it is able to

flow away, and the result is congestion and swelling. The upper part of the outer portion of the bowel, the intussuscipiens, plays the part of the constricting ring in an ordinary case of hernia, and the ultimate result is, if the case go on long enough, or be sufficiently acute, that the intussusceptum becomes gangrenous. It is easy to see that there may be in addition an actual obstruction due to the presence of food, which is unable to pass through the irritated and swollen intussusceptum. This condition is frequently divided into four classes: the ultra-acute, in which death occurs within one day; the acute, where the progress is not so fast, and where the disease may last for about seven days; the subacute, where the progress of the disease is counted by weeks; and the chronic, which continues for a longer time. For practical purposes, that is, in regard to operative interference, it is amply sufficient to make two classes, the acute and the chronic. In the former, opinions have to be made and acted on quickly, for an acutely strangulated piece of bowel does not give much time for deliberation, the pathological changes occur with great rapidity, and the result of a few hours' delay may be so serious that any operation ought to be performed as soon as it is decided on, whether during the day or night.

In chronic cases there is more time to deliberate, and, while all unnecessary delay is to be deprecated, still a day or two is not likely to make any material difference in the result.

Symptoms of Acute Intussusception.—These are caused, first, by obstruction more or less complete; and secondly, by the pathological changes which take place in the part of the bowel which has been constricted. The first symptom caused by the invagination of a piece of bowel into another is pain. This comes suddenly and without warning, it comes in spasms, and, like most colicky pains, is more severely felt about the umbilicus. Soon it becomes more constant, with acute exacerbations, and it does not tend to subside until the bowel becomes gangrenous; then, if there be a perforation, it becomes very acute, and spreads over the whole of the abdomen.

Tenderness may be felt at first over the position of the invagination, though this symptom is by no means constant, and after a time the whole of the abdomen becomes sensitive to the touch.

A most important sign is the passage of blood from the bowel; there is at first diarrhœa streaked with blood, then bloody mucus is passed, and finally there may be blood accompanied by occasional scybala. There is a very constant desire to go to stool, more especially if the invagination be into the rectum; but nothing, or only a little blood, is passed, and the tenesmus remains as distressing as before. Differing from other cases of obstruction, the prominent symptom of distension is absent, unless there be some accidental block; indeed there is not infrequently retraction of the abdominal wall, and distension may not occur until the bowel has become gangrenous and a perforation has been the result.

A well-defined tumour is usually found unless the abdomen be accidentally distended. It may be felt either through the abdominal wall or from the rectum. When situated in the abdomen it is more or less sausage-shaped, and may be of almost any length, commonly about five or six inches; or it may be curved, this being especially the case when it is long. Examination of the rectum must never be omitted.

An early and usual symptom is collapse; it is caused by the pain, combined with the injury to the gut, and the hæmorrhage. Nausea and vomiting are met with sometimes, but they are by no means invariably present in the early stages, and fæcal vomiting does not occur unless there be actual obstruction. The pulse gradually quickens, and the patient dies of acute septic poisoning.

In a simple case, uncomplicated by obstruction, there should not be any difficulty in coming to a correct diagnosis of the condition of the bowel; and doubt arises only when the exact state inside the abdomen is masked by symptoms of actual obstruction. In the very young also it may be by no means

easy to make a correct diagnosis, and when the patient is not old enough to speak, the symptoms will consist chiefly of restlessness, with straining, and sudden fits of crying, accompanied by the passage of mucus and blood. When the strangulation of the intussusceptum is rapid, the symptoms will be proportionately acute.

In the acute cases nature has not been able to prepare the way for a spontaneous cure, and the patient dies, because there has not been time for adhesions to take place so as to prevent an opening being formed into the peritoneal cavity when the invaginated piece of gut becomes gangrenous. When the disease is not so acute, adhesions are often met with, and if these connect the gut at the ring firmly, they preserve the continuity of the bowel, when the gangrenous and now useless intussusceptum is thrown off.

Symptoms of Chronic Intussusception.—These may extend over many weeks or even months, and they resemble generally those of the acute form. The pain is not so severe, nor is it so continuous; it is still spasmodic; but in the intervals the patient does not suffer. As a rule there is neither local nor general tenderness.

Diarrhœa and the passage of blood, which are such prominent signs in the acute cases, are by no means so diagnostic. The bowels certainly may be loose, but they may be confined; or they may be sometimes the one and sometimes the other. Blood may or may not be present, and the same can be said of tenesmus.

Distension will not be present unless intestinal contents close the diminished lumen of the bowel at the invaginated part.

A tumour is made out in about one half of the cases.

There is no collapse, but nausea and vomiting are likely to be present, especially during the attacks of pain. There is loss of appetite, and symptoms of gastric derangement; gradually the patient loses ground, becomes weak and emaciated, and may die of exhaustion.

When the intussusceptum sloughs and separates after firm adhesions have been formed round the ring the symptoms are not so much general as local; the dejecta become intensely putrid, due to the admixture of gangrenous debris; blood is present, and diarrhœa frequently appears. Although this is the way in which nature secures the life of the patient, the ultimate result of the curative process is not always satisfactory, for there may be a perforation formed later, and such an accident must be followed, almost of necessity, by fatal septic peritonitis. Stricture of the intestine may also result from the separation of a piece of intestine in this manner.

The frequency with which separation occurs is regulated by the severity of the symptoms, and as the disease is commonly more acute in children than in adults it is found that the older the patient the more likely is separation to take place.

Treatment of Acute Intussusception.—This must, in the first place, be directed to the general health of the patient, and it is unfortunate that this is apt to be forgotten in the interest which is taken in the local disease. The patient is to be kept quiet and warm in bed, the pain relieved by a large poultice and by a small dose of morphia. As it seems useless to hope that an intussusception will return to its natural position, treatment ought not to be delayed. The treatment will lie between insufflation of the bowel from below and operation. The former plan, when properly carried out, is not accompanied by danger, and as few preparations are required, little time need be lost before an attempt is made to reduce the bowel by this means. It must always be tried before recourse is had to operation.

Water has been used instead of gas to distend the bowel, and it might be satisfactory when the invagination is situated near the rectum. When the mischief is high up in the small intestine a greater amount of pressure is required than is necessary with the gas, and the weight of the water is also a decided disadvantage.

It is now known that gas introduced into the rectum can be made to pass through the whole length of the digestive canal; the ileo-cæcal valve does not offer any insuperable obstruction, and a slight additional amount of pressure is all that is required to drive the gas as far as the stomach, after it has reached the lower part of the ileum. The homely plan of blowing air into the rectum with a pair of bellows has been the means of reducing many an invagination; but it is not altogether safe, and, as one cannot estimate correctly the amount of pressure which is being used, even healthy intestine may be ruptured. In every case where the insufflation method is employed the lower part of the intestine must be cleared out with a large injection of warm water containing soap and castor-oil, and the patient is then anæsthetised. The nozzle of the bellows is inserted into the rectum, and while the anus is held tightly round it by an assistant the air is to be blown in slowly and steadily. A sudden lessening in the amount of pressure indicates that reduction has been effected, or that the unfortunate accident, rupture of the intestine, has occurred. To distinguish between these it is necessary to go on with the insufflation carefully, and as gently as possible. If a rupture have occurred the abdomen will become generally tympanitic; whereas, if the gas be confined to the intestine, the tympanitis will spread more from below upwards.

Senn states as an absolute fact that healthy intestine does not rupture when the pressure is less than 8 lbs. to the square inch, when the patient is not anæsthetised. He advises the use of hydrogen gas, as it is perfectly harmless and is rapidly removed by absorption. The gas is put into a rubber reservoir, to the tube of which a manometer is connected; this regulates the amount of force which is being used, when the hydrogen is driven out by the pressure of the hand from the rubber bag. Experiment has shown that a pressure of from $\frac{1}{4}$ lb. to 2 lbs. is sufficient to overcome the resistance offered by the ileo-cæcal valve, and that a slight increase will

drive the gas the whole length of the alimentary canal. The administration of an anæsthetic renders the passage of the gas somewhat more easy by removing the resistance of the muscles of the abdominal wall. All pressure must be made slowly and steadily.

The hydrogen gas can be prepared without any elaborate apparatus. What is required is simply a Wolff's, or a large wide-mouthed bottle, in which a couple of ounces of pieces of zinc are placed; through the cork a short, straight glass tube reaches to nearly the bottom of the bottle, and a longer bent one passes for a short distance only through the cork. The sulphuric acid and water necessary for the completion of the chemical action is to be poured in through the short tube, and the gas finds its way through the bent one, to which the rubber bag is attached. The capacity of the bag should not be less than three or four gallons. It will be filled in about ten minutes, and is disconnected from the bottle after the stop-cock has been closed.

The ordinary end of an enema syringe, whether of bone or metal, is fixed on to the end of the rubber tube, and is then passed into the rectum. Steady pressure is to be made on the bag after the stop-cock has been opened, and the assistant prevents the return of the gas. The position of the patient may also help in the reduction, as by having the hips high the advantage of the action of gravity is obtained.

When we are dealing with gut whose vitality has been lowered, as in a case of intussusception, pressure, as shown by the manometer, must never be allowed to exceed 2 lbs. to the square inch for fear of causing rupture; and it is stated that, should the gut rupture under such a pressure, it shows that the condition of the bowel has been such that the operation was imperatively called for. When the gas is being injected the hand should be kept on the tumour if it is to be felt, and its altered condition and final disappearance will be easily noticed when the injection is successful. Should there be no tumour

we must remember that two points of resistance have to be overcome, the one at the ileo-cæcal valve and the other at the intussusception; these may be close together or far apart, and the pressure diminishes as the gas passes each one. If there be an invagination at two points one only may have been put right; it is therefore proper to go on with the insufflation of the gas until the whole of the alimentary canal has been distended, always bearing in mind that the pressure must not be raised beyond the 2 lbs. to the square inch. To be sure that the hydrogen gas has traversed the whole length of the alimentary canal a tube is passed into the stomach, when the presence of the gas will be shown if a lighted match be applied. The flame can be easily extinguished by pressing the tube. When the hydrogen has reached the stomach it does not necessarily mean that the intussusception has been reduced, for the gas may travel through the centre of the invaginated bowel. When there is a sudden diminution in the pressure, and there is a fear that a rupture of the bowel has taken place, the insufflation is continued, and the signs are the same as when this accident has happened after using the bellows. Should the insufflation of hydrogen gas fail, or should a rupture occur during its use, nothing remains to be done except to operate.

Operative Treatment.—After what has been so often said it is perhaps scarcely necessary to repeat that the patient must be kept warm and prevented from getting wet by using the perforated rubber sheet, etc. The incision is always to be made in the middle line, and must be large enough to admit of the passage of the hand into the abdomen. The invaginated portion of the bowel is usually found without much difficulty, and is to be drawn with great care and gentleness into the wound, or as near it as is possible. The next thing is to examine it carefully, and to determine if there be any evidence whether or not the injury has been so acute as to cause death of the intussusceptum, for should there be any signs of gangrene, it would be simply a waste of precious time to attempt reduction. When the bowel

appears to be healthy, careful but not too prolonged attempts must be made to bring it back into its natural position. Before this is done warm sponges are to be arranged so that the cavity of the peritoneum is shut off as far as possible ; exposure of the rest of the abdominal contents is thus avoided, and if rupture should take place during the manipulation, the contents of the bowel are prevented from coming in contact with the peritoneum. The swollen and congested intussusceptum is now to be reduced in size by steady pressure, and when this has been well accomplished, an attempt is made to draw it through the ring, while at the same time the intussuscipiens is to be drawn downwards. Rough traction should be carefully avoided, but the pressure must be kept up very steadily. Should reposition not take place, the bowel is to be again distended with the hydrogen gas, and the traction is to be renewed whenever the gas commences to pass between the invaginated portion and the intussuscipiens, distending the latter. The gas will always pass between these two, as mucous surfaces do not tend to adhere to each other. Should this fail, adhesions will be present, either round the ring or lower down, and these are to be separated, if possible, by passing a probe round between the two pieces of the bowel. If there still be failure, one is apt to be tempted to try to insinuate the tip of the finger, and to break down the adhesions ; but as this implies a decided risk of rupturing the bowel it is well to resist the temptation. Before giving up all attempts at reduction in favour of some form of operation on the bowel itself, a final effort is to be made to sponge off the adhesions ; this is done with a specially soft sponge, the upper part of the bowel being held in the left hand, and pressure being made with the sponge in the right.

After reduction has been effected there may be reinvagination, and to avoid this risk the mesentery is to be shortened in the neighbourhood of the intussusception. This is done by folding the mesentery on itself, the fold being made parallel to the bowel, and it is made permanent by putting in a few stitches.

Before the abdomen is closed we must satisfy ourselves that a second intussusception does not exist, and also that there is not any band or adhesion, which might in itself be a cause of obstruction. Cases have been met with where two intussusceptions have been found, and the presence of adhesions is not an unknown danger. When these questions have been settled the sponges are removed and the wound is closed.

When the gut is found to be gangrenous time must not be wasted in attempting reduction, as it is necessary to remove the dead part. This entails a circular resection of the gut. The bowel is to be removed in the following way: a rubber ligature, passed through a hole made in the mesentery, constricts the gut about four inches or so above the ring; a second ligature is made to surround the intestine below the intussusception; this prevents escape of the contents of the bowel after the diseased part has been removed. Sponges, of course, have shut off the portion of the bowel which is being operated upon from the rest of the peritoneal cavity. The entire circumference of the bowel is next removed, between the upper ligature and the constricting ring, so that one half of a V is made, whose apex is in the mesentery, and in this manner, rather more of that part of the bowel farthest from the mesentery is removed. A second similar section of the bowel is made immediately below the ring and through the upper part of the intussuscipiens. The intussusceptum being now disconnected from the rest of the bowel is to be removed, and the divided ends of the bowel may be treated in various ways. That plan is to be chosen which can be performed most quickly, most easily, most satisfactorily, and with the greatest amount of future comfort to the patient. The choice lies between the formation of a fæcal fistula, a circular enterorraphy, lateral apposition by means of bone plates, and lateral implantation.

The formation of a fæcal fistula by fixing the open ends of the gut in the abdominal wall is a cruel proceeding, unless it be absolutely impossible to treat the case in any other way.

If the patient recover he lives in a more or less miserable condition, and has usually to look forward to a future operation. When this has to be done the cut ends are to be fixed into the most convenient part of the wound; this is better than making a special opening in the inguinal region, looking to the possibility of a second operation in the future. The two ends of gut are to be stitched together at the mesenteric side after the cut in the mesentery itself has been brought together. Stitches are put in the surplus part of the abdominal wound, and are left loose until the bowel has been satisfactorily fixed. This is to be done by passing a stitch through the abdominal wall on one side, taking a good hold of the outer coats of the intestine at the lower part, and coming out through the other half of the abdominal wall. A similarly placed stitch fixes the upper part of the gut. Additional sutures are passed through the wall and gut on one side, and others through the other side, until the united ends of bowel have been firmly secured. The constricting bands on the intestine need not be removed until all the stitches have been introduced, nor are any of the silks to be tied until all are in position.

Circular Enterorraphy.

To bring the ends of the bowel together when they are of equal size is much more easy than when one end has become much dilated, or where small intestine has to be joined to large. Three or four continuous sutures will be required, threaded into the round sewing-needles used in operations on the stomach. The mesentery is first brought together, and the stitches in the bowel are passed through the outer coats only, and do not include the mucous membrane. It is best to begin at the posterior part of the bowel. The peritoneum, as is described in the operation of gastrorraphy, is to be carefully turned in, so that peritoneal surfaces are in apposition. Additional interrupted stitches are to be introduced at any point

that may appear to require them, but they should not be preferred to the continuous for the first row. It need not take long to bring the ends thoroughly into apposition; at most ten minutes ought to be ample time, unless there be great inequality in the size of the two ends. When there is great difference in the size an alternative operation is to be preferred.

The third alternative is that of lateral apposition, or intestinal anastomosis by means of the decalcified perforated bone plates. The gangrenous gut is to be removed, and the rubber bands constricting the intestine above and below are put on in the same way as in the previous operation; the two open ends are to be closed by inverting the wall for about an inch, and then stitching across the end with a continuous silk suture. It is not necessary to put in so many stitches as in circular suturing, a single row is sufficient. The proximal and distal ends being now closed, an incision is made in the longitudinal direction, at the side of the bowel opposite the mesentery, and a bone plate is stitched into position in the way described under the operation of gastro-enterostomy. A second plate is placed in a like manner in the other end, and in such a position that the two will approximate easily. The stitches from the bone plates are tied as usual, the compressing bands on the bowel and the sponges are removed, and the abdominal wound is closed in the ordinary way. When the operation has been carefully performed it is not necessary to wash out the general abdominal cavity unless there be symptoms of septic absorption, the small part of intestine which has been exposed alone requiring to be purified.

The operation of lateral implantation of the bowel is performed by inserting the proximal end into the distal part of the gut in the following way. The distal end is turned in and closed with a continuous suture, and an incision is made, about two inches distant, in the longitudinal direction, and opposite the mesentery, one inch to one inch and a half in length; into this opening the proximal and open end of the

gut is stitched, first by one row composed of several continuous sutures, and then by a second row of interrupted tension stitches.

Of these four methods the choice should lie between the second and third. There is probably little or no advantage in the one over the other, unless one end of the bowel be much larger than the other, except when the operator has not accustomed himself to work quickly; in that case he will probably do better with the lateral anastomosis by bone plates. The operation must not be commenced with the fixed idea that any one way is certain to be the best under all circumstances; but it is well to be prepared to complete the operation in whichever way seems to be most safe after the gangrenous part of the bowel has been removed.

When gangrene has not taken place, the removal of any part of the bowel would be running the patient's life into unnecessary danger. If a channel be made for the free passage from the intestine above the intussusception to another part below, pressure is relieved at the invaginated part, and the intussusceptum does not become gangrenous. This artificial passage ought always to be made by the help of the bone plates, and no greater length of gut than is absolutely necessary should be excluded from the alimentary canal. It will occasionally happen that on account of the position of the intussusception it will not be possible to approximate the bowel by the help of the bone plates. This will happen when this diseased condition is near the rectum. Here colotomy will have to be resorted to; and, as it is a simple matter to determine the exact relations of the colon when the hand is inside the abdomen, one will be able to decide whether a lumbar or inguinal incision will be the better. In any case a second incision will be advisable, and, as will be seen later, we are inclined to favour the lumbar operation whenever there is no special contra-indication.

When a case is not seen until the condition has become chronic there is not any immediate hurry to operate, at least for a few days. The treatment does not vary in any particular

detail from that of the acute; inflation by hydrogen gas may be tried, and if it fail operation is to be had recourse to, for it is not advisable to wait in the hope that the intussusceptum will be thrown off and the patient recover. The illness would be a prolonged and dangerous one, and if he survived, the ultimate result is known to be often unsatisfactory.

Obstruction due to Bands and Adhesions.

The exact conditions which are met with under this heading are somewhat numerous. In the first place, when a band is the cause of the obstruction, it may be found to be free at one end, and to have twisted round a knuckle of intestine. Sometimes a band may be found to be fixed at both ends; in such cases a piece of intestine may pass underneath it and so become strangulated. Both of these conditions may also be caused by a diverticulum. At other times the bowel may pass through an opening either in the mesentery, or omentum, or into the obturator foramen, or through the foramen of Winslow. Finally, there may be an adhesion of intestine to a fixed point, and this may cause obstruction by the formation of an angle.

Symptoms.—It is not possible, and fortunately it is not of any practical importance, to be able to differentiate the symptoms due to the presence of any of the foregoing conditions from one another, for all the symptoms are very much alike. Usually the first thing to be noticed is the sudden onset of pain in the abdomen. This may occur without any previous history of trouble of any kind in that region. In some cases the patient may have previously suffered from an attack of peritonitis, localised or general, or from an injury to the abdomen, or some operation may have been performed. The pain is severe, of a griping character, and like most pain in the intestines, is often referred to the umbilicus rather than to the seat of the obstruction. At first it comes decidedly in paroxysms, with times of complete relief; later on it loses much of its

spasmodic character, and becomes continuous. The abdomen quickly becomes tender, and begins to distend. The tenderness is sometimes referred to one particular spot; at other times it is felt all over. At the commencement of the attack flatus may pass and the bowels may move; but this is due simply to the emptying of the gut below the seat of obstruction. Soon flatus ceases to pass. As the abdomen distends vomiting sets in, and after a time it becomes fæcal, unless the obstruction be very high up in the small intestine. There is often collapse when the attack first commences; the pulse becomes weak and rapid; the temperature either does not rise, or is subnormal, unless there be acute peritonitis; the breathing becomes quick; the tongue becomes dirty, and the patient is continually wishing for something to drink. Hiccough also may be present. The urine becomes scanty, and there may be almost complete suppression.

All these conditions occur more frequently in men than in women, and the most usual age is between twenty and forty. The constriction is to be looked for, as a rule, in those parts of the abdomen most prone to be the seat of inflammation, as, for example, in the right iliac region, and in the pelvis. The cause of death is due either to exhaustion with failure of the heart; or to peritonitis; or to septic absorption; or more usually to a combination of these conditions.

Treatment.—Operation must follow the diagnosis, for medical treatment cannot rectify a mechanical wrong. The operation will always be somewhat of the nature of an exploratory incision, as an absolutely precise diagnosis is quite impossible. The preparations are to be made as usual, special attention being paid to keeping the patient warm. It is not necessary to wash out the stomach; this simply exhausts the patient, and does not help us in any way. The whole of the surface of the abdomen is to be scrupulously washed with a strong solution (1 in 1000) of the perchloride of mercury, and the perforated rubber sheet ought always to be used.

The incision is to be made in the middle line, between the umbilicus and the pubes, rather nearer to the former, and with ordinary care there is no risk of injuring the distended coils of intestine. The first incision should be long enough to admit two fingers easily, unless the abdomen be much distended, for in that case the opening must be large enough to admit the hand. As soon as the peritoneum is opened the two fingers of the left hand, or the whole hand, as the case may be, are passed down to the right iliac fossa; if nothing be found there they explore the left iliac region, unless the ascending colon is found to be contracted; and, if the obstruction has not been found, the incision is to be enlarged to the extent of admitting the whole hand. This length of incision is likely to be enough for all purposes, but there is no objection to making it longer if that appear to be more convenient; but it must not be made too long, unless it be intended to turn out the intestine *en masse*, *i.e.* eventration. If an obstruction be not found in the two most likely situations, the best plan is to go systematically over the intestine until the obstructing point is reached. This is to be done by making a fixed point of the most swollen piece of gut within sight; either by passing a ligature through the mesentery, the ends of which are held by the assistant; or the gut itself may be held with the finger and thumb without employing any ligature. This is the better way. The surgeon then commences to draw out the bowel, and as it is drawn out at one end it is pushed in at the other. This may be begun either towards the obstructing point or away from it; after passing two or three feet of bowel through the hands in this way one is enabled to judge whether the obstruction is being approached or not by noticing the size of the gut, the amount of congestion, the thickness of the wall, and the state of the contents, these becoming more fluid the nearer the obstructing band is reached. When it is found that the examination has been made in the wrong direction the advantage of having a fixed point of commencement is seen, for one can begin again in the opposite

direction without having to go over a second time the bowel already examined. The obstruction having been reached, its treatment will depend on the exact cause, and on the condition of the gut. It will only be possible to indicate generally how the conditions are to be treated; they vary to such an extent that every case will have to be treated by the surgeon in the way which, under the circumstances, appears best. Bands of all kinds, whether free at one end or adherent at both, must be divided near their base, and tied with catgut.

A diverticulum, not uncommonly seen in those who have a malformation elsewhere, as a hare lip, cleft palate, etc., will require a little more care; sometimes the base of one of these is as large, or nearly as large, as the intestine, and when this is so, the cut end should be invaginated, and the peritoneal surfaces brought together with a continuous suture of fine silk. When the bowel has passed underneath a band fixed at both ends, the whole length of gut which has been obstructed must be carefully examined, so as to be certain that there are no secondary adhesions of one part to another. The band is to be ligatured at both ends and then divided.

Should intestine have passed through a slit in the mesentery or omentum, or through the displaced ring of a hernia, the opening is to be enlarged and the bowel reduced, the whole amount which had passed through the opening being examined for a second obstruction or for gangrene. The opening must be closed with fine silk, peritoneal surfaces being brought into apposition. One case is recorded by Treves, who has had a large experience of intestinal cases, where the bowel had passed into the lesser bag of the peritoneum through the foramen of Winslow, and several others have also been reported. In all it was found to be impossible to withdraw the bowel through the foramen, and it was, of course, impossible to enlarge that opening. One of these cases recovered spontaneously after the abdomen had been closed.

When a part of the circumference of the bowel is fixed at one point there will always be a certain amount of obstruction.

This will not necessarily be complete if the bowel be healthy, as it will often stretch at this point; but should there be in such a case any condition of the intestinal wall which will prevent dilatation, a complete stoppage may be the result, the block being caused by the pressure of the proximal part of the gut on the distal. The indication here for the treatment of the bowel is very simple, and consists in separating it from its fixed position, and in covering both the raw surfaces so formed by bringing the peritoneum together by stitches.

An obstruction caused in this way may result from the passage of an appendix epiploica through the side holes of a drainage tube; but this is only likely to occur when the holes have been made too large. We have only seen one case of this kind; it occurred after the removal of a double pyosalpinx. No flatus passed for forty-eight hours, the abdomen was beginning to distend, the pulse to quicken, and the patient complained of pain in the position of the tube; and, as only a little clear serum could be withdrawn, it was removed. Although it could be rotated freely it did not come out easily, and before it had been half withdrawn the patient complained of great pain. As the lower end came out it was seen that a little piece of fat, evidently an appendix epiploica, had passed into the tube through one of the side openings. It was firmly fixed, and a considerable amount of force was required to pull it out of the tube. Within an hour flatus was passing freely, and the patient made an uninterrupted recovery.

In all cases of obstruction by a band through an opening or at an angle, we must never be satisfied until the whole length of gut which has been in any way interfered with has been carefully examined, and until it has been determined that no other obstruction exists in the abdomen. When the bowel is found to be healthy the abdomen is closed, and a drainage tube is not required.

In some cases the peritoneal covering of the intestine has been injured during the separation of an adhesion, or from great

distension; and as this may lead to a future adhesion of the part, the peritoneum on each side of the crack or tear must be drawn over it by a continuous suture. The direction of this kind of union ought to be made as much as possible transversely to the axis of the bowel, for in this way the lumen is not narrowed. Should there be one or more gangrenous spots, the rest of the wall being undoubtedly healthy, they may be cut out, an oval incision being made in the transverse direction, and closed with the continuous suture. A small opening made in the course of any abdominal operation is to be closed in a similar way. When a considerable portion of the bowel is gangrenous, a resection of the whole circumference must be made; before this is done a rubber band is fixed on above and below, as described in intussusception, to control the contents of the intestine. They must not be put on too near to the gangrenous part, for the obvious reason that the vitality of that part of the bowel is likely to be lessened. The gangrenous portion is now to be cut out, going thoroughly clear of any doubtful or injured part; the direction of the section is to be V-shaped, the angle being in the mesentery, and the very greatest care is taken to prevent soiling of the peritoneum. Bleeding vessels are secured by fine catgut ligatures; the proximal opening being kept well forwards outside of the wound, the constricting rubber band is loosened to allow of the intestinal contents being emptied out. If bone plates are to be used, the end of the gut may be washed out with warm water after it has again been constricted. The two cut ends may now be stitched together, or the continuity of the bowel may be restored by lateral apposition and the use of decalcified bone plates. Of these two methods the choice will always be made of the latter when the one end of gut is much larger than the other; where the openings are of somewhat similar size there is not much to choose between the two methods, and the one will be adopted which the surgeon feels he can do more easily. Both of these operations have been described in

connection with intussusception, and nothing further need be said.

In all cases where the bowel is found to be gangrenous, and also in those where its vitality is evidently deteriorated, the abdomen must be thoroughly washed out with warm water, and a drainage tube left in, as in those cases some septic infection may have passed from the intestinal tract into the peritoneal cavity.

Volvulus.

This is the rarest cause of intestinal obstruction, and is always acute. It is a twisting of the bowel on itself, causing obstruction in the blood supply passing through the mesentery, and followed by œdema of the wall of the part of the intestine involved in the twist. A twist of this nature can occur only when the mesentery is abnormally long; it is therefore usually met with in those situations where this is naturally the case, viz. in the sigmoid flexure and in the lower part of the ileum. In addition to this elongation of the mesentery, which appears to be invariably present, there may be found a somewhat constricted portion of the intestine. In other cases there may be a history of persistent constipation; this condition is usually met with about middle life.

Symptoms.—These consist in the history of constipation, though this is not always present; and in cases where there is narrowing of the gut, there may have been some antecedent abdominal symptoms, such as dyspepsia, slight distension, and attacks of pain about the navel. The formation of the volvulus is accompanied by a sudden and severe attack of pain of a colicky nature, referred to the neighbourhood of the umbilicus; and along with this there is usually some distinct evidence of collapse. Soon the pain spreads over the whole of the abdomen, and is accompanied by tenderness, at first over the situation of the twist, and later on becoming general. Vomiting then commences, and the abdomen begins to distend. Tenesmus, which is complained of

when the volvulus is situated at the sigmoid flexure, is not so likely to be a prominent symptom when the twist is farther from the rectum. The pulse becomes rapid and small, there are the usual symptoms following any great general injury, and the patient may die within two days of the onset of the attack.

Treatment.—In this condition, more than in any other of acute obstruction, treatment must not be delayed. The first thing to do is to attend to the patient's general condition, and to obtain a good nurse. It is impossible to rectify the twist by any action from above, and it is said that it cannot be rectified by inflation from below; still it would be right to make the attempt with hydrogen gas if the patient be seen shortly after the first onset, for one cannot say with certainty that it will not succeed in undoing the twist, and it is possible to conceive that a case may be cured if treated early, although the doubt would always arise in such instances as to what had really been the nature of the obstruction.

When a case of obstruction has been diagnosed to be due to the presence of a volvulus, and when inflation by hydrogen gas has failed to bring relief, the sooner the operation is performed the more likely is the patient to recover, and nothing can possibly be gained by delay.

The Operation.—The incision is to be made in the middle line, between the umbilicus and the pubes. When the volvulus has been brought into view, it can be easily untwisted if the operation have been performed sufficiently early. If this fortunate result be obtained, a recurrence of the condition must be prevented. It has already been said that there is invariably a long mesentery, and this will require to be shortened. It can be done very simply by making a fold in the mesentery parallel to the bowel, and keeping it in this condition by a few stitches. Removal of any part of the mesentery must not be thought of, for a very evident anatomical reason. Reduction may not be effected so easily; there may be considerable matting together and adhesions in addition to the simple twist; or more than one loop of intestine may be affected. Should it be impossible to return the

gut to its natural condition, the contents must be emptied out through an incision made in the most prominent part of the bowel, in the longitudinal direction, and at the opposite side to the mesentery; care must be taken to prevent any soiling of the peritoneal cavity, which is closed by sponges, so as to prevent, as far as possible, infection from intestinal gases. After the bowel has been fairly well emptied, the incision may be closed by a continuous silk suture, or the lips of the wound may be kept together by the fingers of the assistant. Should it still be impossible to rectify the volvulus a lateral anastomosis by means of decalcified bone plates should be made, connecting the gut above and below. This is undoubtedly better than making an artificial anus as a routine practice. When gangrene has supervened, the dead tissue must be removed, and a lateral anastomosis or a circular enterorraphy may be made, or both ends may be fixed into the wound, as may seem best at the time.

Enteroliths.

One more acute form of intestinal obstruction remains to be noticed. In the lumen of the gut may be found a foreign body, or, what is practically the same thing, a substance known by the name of an enterolith. The latter is secreted by the intestine, the former is usually a biliary calculus. Quite a large concretion may be present within the intestine without creating an obstruction; the actual block appears to be formed partly by the mass and partly by the irritation it sets up in the bowel, so that in this way a comparatively small stone may cause complete obstruction.

Symptoms.—They may be those due to a sudden obstruction as by a band, or there may be a history of previous intestinal trouble, sometimes of long standing. When a gall stone is the cause, there will be probably a history pointing to some liver disturbance, jaundice perhaps; or when the nucleus of the blocking substance consists of a gall stone, there will have been antecedent biliary

colic. A single gall stone of sufficient size to close the bowel can only have reached the intestine by a process of ulceration. When the obstruction is high up in the intestine there cannot be much abdominal distension; vomiting would be the more prominent symptom.

Treatment.—Operation holds out the only hope of relief in all cases when purgation has been tried and has failed. The steps of the operation are the same as those previously described up to the point where the obstruction is reached. It is useless to attempt to push on such a concretion; but as it can sometimes be broken up, a strong round needle is to be inserted through the coats of the intestine below the obstruction, traversing the wall in an oblique direction; and with the needle an attempt is to be made to break up the mass, which is fixed with the left hand. The part of the bowel with which the mass is actually in contact will have had its vitality lowered by the pressure upon it. It must be handled therefore with great gentleness; and, if the needle do not manage to reduce the size of the block easily, a prolonged effort must not be made, but the obstruction must be removed through an incision.

It is usually recommended that the stone should be pushed onwards or backwards to allow of the incision being made through a healthy piece of intestine, and when this can be easily accomplished it is right to do so. A stone can seldom be pushed onwards, and, unless the case has been operated on very early, a healthy part of intestine may be several feet from the proximal side of the block, and nothing but harm would be done by prolonged manipulation of the stone, if it be firmly fixed. The rule must be to push on the stone if it will go easily; if this be not possible, it must be pushed backwards if healthy gut be near; and, if neither of these can be managed, an incision will have to be made over the concretion itself. In any of these three situations the incision is to be made in a longitudinal direction, and through the convexity of the gut. The opening is to be kept well forwards, and the fluid contents are allowed to flow

into a basin; this action being assisted by raising the coils and allowing the contents to pour out. The opening is closed by a continuous suture, and when the incision has been made through swollen tissue, two rows, or perhaps three, will be required, and a good grasp must be taken of the peritoneal and middle coats. When the pressure has been so great that the bowel has become gangrenous, resection must be made, and the divided ends treated either by the bone plates with lateral anastomosis, or by fixing both ends in the wound, either of these being preferred to the circular stitching, as the proximal end of the bowel will be much dilated and softened.

The Differential Diagnosis of Acute Obstruction.

The importance of coming to a correct diagnosis can hardly be exaggerated, and before attention is given to what may exist inside the abdomen, the possibility of a hernia must invariably be excluded. With this proviso it is fortunately only necessary to differentiate those cases which require operation, and those which can recover without operation; but to do this with anything approaching certainty one has to arrive at as correct a knowledge as possible of the exact condition which exists inside the abdominal cavity. This is not always possible, indeed one must sometimes open the abdomen without this knowledge, being induced to do so by the general condition of the patient, and by the fact that all treatment has failed to remove the obstruction. An excellent example of such a condition is the following. A lady fifty-four years of age, of gouty constitution, was seized suddenly with intermitting abdominal pain in the region of the umbilicus; at first there was no sickness, and the abdomen distended but slowly. In the position of the splenic flexure of the colon there was some slight tenderness, and the surgeon who first saw the patient after the abdomen was somewhat distended thought he felt a swelling in that position. Five days after the onset of the attack vomiting commenced, and this

continued about once or twice in the twenty-four hours until the day she died. When seen ten days after the beginning of the illness the appearance was fairly good, pulse 108, temperature normal, general distension of the abdomen not very great, colicky pains at the navel, no general pain, slight tenderness at the splenic flexure of the colon and nowhere else, no dulness. The bowels had moved slightly the night before. There was a history of two slight former attacks of obstruction, the second of which, two months before, gave way under treatment for gout. The patient was seen again on the thirteenth day, the condition was much the same as before, flatus had passed occasionally, a considerable quantity in the morning, pulse was 96, and temperature remained normal. Next day the patient's aspect was not so good, there was more distension, and the pulse had risen to 108. It was determined to open the abdomen, and several hours before this could be done there was severe pain all over. The condition found was that of perityphlitis, with pus in the abdomen, and there was in addition a rupture of the ascending colon. With the exception of the two previous attacks there was nothing whatever which pointed to this condition. For the purpose of diagnosis we may divide the conditions of acute obstruction into the three groups: of paresis due to nervous exhaustion; of intussusception; and of obstruction due to bands, adhesions, twisting, herniæ, and to the presence of concretions. The following table shows how little difference there is between these conditions, and how frequently, even in typical cases, the symptoms of one class resemble those of another. So true is this, in the more indefinite cases, that too much attention must not be paid to book knowledge when at the bedside; experience is sometimes the only guide; and especially must we remember that the general condition of the patient must not be allowed to fail while we are seeking for a correct diagnosis.

[TABLE.

TABLE COMPARING THE SYMPTOMS OF THE DIFFERENT FORMS OF OBSTRUCTION.

	Paresis.	Intussusception.	Bands, Adhesions, Volvulus, and Concretions.
Age . .	Early or middle life.	Most common in children under the age of ten.	Most common in middle life.
History .	Excessive exercise or errors in diet.	Sometimes diarrhœa or the presence of an irritation, as worms.	Frequently a history of antecedent peritonitic attack if due to bands or adhesions. Constipation if due to a volvulus. Gastric or intestinal disturbance if due to concretions.
Condition .	Robust.		
Pain . .	Sudden, intense, and colicky, gradually passing away.	Sudden, colicky, gradually getting worse, and may be marked at one spot.	Sudden, colicky, becoming steady and general. Becoming steady with acute exacerbations if due to a volvulus.
Bowels .	Absolute constipation.	Diarrhœa; with passage of bloody mucus, and tenesmus.	Absolute constipation.
Vomiting .	Immediate, passes off and returns with the distension.	Does not appear early.	Early if due to bands or adhesions. Late if due to a volvulus or concretion, depending on the situation.
Distension .	Comes on within a few hours.	Usually retraction.	Early in a volvulus. Not so early in the others.
Tumour .	None.	Usually present.	None.
Localised tenderness	None.	Present over tumour.	None as a rule. Occasionally in a volvulus or concretion.

There is a certain amount of similarity in the operations which can be performed to relieve an acute obstruction, no matter what is the exact cause. Before opening the abdomen it is essential that arrangements be made for keeping the patient warm, so as to reduce the shock as far as possible. The patient must be both warmly dressed and warmly covered, hot bottles must be kept to the feet, and if he be much reduced others may be put round about him. In addition the body is to be entirely covered with indiarubber sheeting. A slow deliberate operator is out of place in such operations, and so also is one who cannot manipulate gently, for the gut is often soft, and may be easily torn. As such operations may have to be performed at very short notice, it will often fall to the part of the surgeon to disinfect the skin of the abdomen after the patient is on the table, and he must not fail to inquire if the bladder has been emptied before the administration of the anæsthetic has been begun, for every morsel of space gained is an advantage. The incision is always to be made in the middle line below the umbilicus, and in every case where the abdomen is not much distended, one long enough to admit two fingers will be at first sufficient. The fingers are to be passed to the right iliac region. If that part be found to be healthy, and the ascending colon contracted, one need not examine the sigmoid flexure, but must withdraw the fingers and enlarge the wound to the extent of admitting the hand.

When there is much distension, a four or five inch incision is made at once, as the two fingers are not long enough to examine much of the abdomen. If nothing be found amiss in the right iliac fossa, and the ascending colon be found contracted, and if the examination of any tender spot have not revealed anything, the gut is to be gone over, drawing it out at one end and pushing in at the other in the way already described. The obstruction having been found in this way, or possibly after eventration has been resorted to, the next thing will be to remove it if possible without injury to the gut; or to make an

artificial anastomosis if the gut be fairly healthy; or to resect a part if it be seriously damaged. Bands are to be divided and removed; openings are to be enlarged and the prolapsed gut withdrawn, the rent being then closed with sutures; a volvulus is to be untwisted and the mesentery shortened; and an invagination is to be reduced by taxis and the mesentery again shortened.

In the more serious cases where it is not possible to relieve the obstruction in any of these ways, and where the gut has not become gangrenous, a connection is to be established between the intestine above and that below, so as to cut out from the intestinal tract, at least for a time, the obstructed part. By doing this rest is given, and in some cases nourishment may pass through both the old and the new channels; but if the obstruction remain permanent that part of the bowel which has been cut off by the short circuiting becomes atrophied.

In adopting this plan of treatment one precaution must never be lost sight of: it is not to remove too much of the gut. It must be evident that digestion and proper nutrition cannot go on if too much of the small intestine be cut out of the alimentary tract, and that when this is done the patient will inevitably die of marasmus. At present statistics are wanting which would tell us how much and what part can be removed with safety. The removal of four feet of small intestine has resulted in death from marasmus, and the same result would have occurred if an equal amount had been cut out by the formation of an anastomosis, unless the obstruction became removed and the gut returned to its functional activity.

When the bowel has become gangrenous at a single point, an oval incision may be made completely free of the dead part, and the opening thus formed closed by a continuous silk suture. The direction of the opening must be transverse, so as to prevent any diminution in the size of the gut.

When the gangrene is more extensive the whole of the injured part must be removed by incisions made completely

free of the disease and through entirely healthy tissue. The divided ends of intestine may be treated in one of the three following ways : the openings may be inverted and closed with a continuous suture, and the continuity of the bowel preserved by lateral anastomosis by means of bone plates; the ends may be sutured together; one or both ends may be fixed in the wound, or in an incision made for the purpose.

Lateral anastomosis is to be preferred when the proximal end has become much larger than the distal. When there is not much difference in size, the choice between lateral anastomosis and circular stitching will depend on the inclination of the surgeon, and also on the ease or difficulty in bringing the bowel together by either method. When the patient is very much debilitated, the cut ends may be fixed in the wound if it be expected that the continuity can be restored at some future time; or, when this cannot be hoped for, the proximal end is brought through an opening made at a convenient spot, and the distal end is stitched across, and either fixed into the wound or allowed to drop back into the abdomen.

During the performance of any of these operations the peritoneal cavity and the rest of the intestines must be shut off by warm sponges, and whenever the bowel has been found to be gangrenous the cavity must be washed out, and a drainage tube introduced to drain from the bottom of the pelvis. The after treatment will not vary from any other ordinary abdominal operation, and it is not necessary to wash out the stomach either before or after.

Enough has been said in the foregoing pages to show how gangrenous bowel, discovered during an operation for hernia, and usually recognised as belonging to general surgery, is to be treated. The principle to act on is to consider the life of the patient first, and his future comfort second. In a debilitated subject an artificial anus must be made, and it can be closed at some future time; but when the general condition is good, the wound is to be enlarged, the gangrenous gut removed, and the

continuity restored either by circular enterorraphy or by lateral anastomosis.

Puncture of the Intestine.

An additional method of treatment which has been extensively revived of late years requires to be mentioned.

When an abdomen is greatly distended with wind one is inclined to think that by making a small opening into the bowel with a hollow needle the distension will be relieved, at least for a time. Unfortunately this is not the case; and unless a large number of punctures are made, no appreciable difference is seen in the size of the abdomen, a few inches of gut only being emptied by each puncture. Even when an incision is made into the gut, it is remarkable how little gas comes away naturally. It is actually unsafe to puncture a distended coil of intestine, for even the opening made by a fine needle may allow of the escape of gas or fæcal matter into the peritoneal cavity This risk would not be sufficient to condemn the practice if much relief were obtained, but when we consider that little reduction in size can be expected, the practice is one which ought not to be recommended.

Chronic Obstruction.

Cases of this form of obstruction are most conveniently divided into two groups; the one where the obstruction is due to a simple cause, and the other where it is due to malignant disease. These forms of chronic obstruction may be divided in the same way as the acute, into mural, extra-mural, intra-mural, and combinations.

Chronic mural obstructions are caused by fibrous strictures due either to hyperplasia, or to a cicatricial contraction following ulceration, intussusception, or any other injury to the bowel. A second cause is congenital stenosis, and the last is the thickening resulting from malignant disease.

The extra-mural causes are those due to the outside pressure of a tumour, of an abscess, or of an hæmatocele.

The intra-mural causes are the presence of fæcal accumulations, or of polypi, although the latter might also be classified under the head of mural obstruction.

Symptoms.—These are very much alike in all the different forms of chronic obstruction, and at the commencement, and for a long time, may indicate nothing more than some derangement of the digestive system. At times the patient may be perfectly well, or he may suffer from attacks of colic situated in the usual region at the umbilicus. These attacks may be accompanied by vomiting, though this symptom is not often present; in addition there may be some distension accompanied by constipation, which is, however, easily relieved by an aperient. The pain usually commences some hours after food is taken, and between the attacks there may be constipation, or diarrhœa, or these conditions may alternate. There is always dyspepsia. As the disease progresses and the obstruction becomes more marked, all of these symptoms become increased, and the patient begins to lose flesh. Some time or other there is an acute attack of obstruction, and if it be not relieved the patient dies quickly, the general condition having been impaired by the previous derangements of digestion, etc. These symptoms are common both to simple and to malignant stenosis, the only difference being that in the latter emaciation is likely to be more rapid than in the former.

The dangers of chronic obstruction are twofold; there is first the risk that the diminution in the lumen of the gut may be the cause of a complete block, and that death may result from acute obstruction; and secondly, as the bowel on the proximal side of the narrowing becomes dilated, a pouch is formed as we have already seen is the case in stricture of the œsophagus, the vitality of the dilated part becomes diminished, the contents lie there and undergo putrefactive changes, and a combination of these two conditions leads to ulceration of the mucous membrane, and eventually it may be to perforation.

The most common situation of the fibrous variety of stricture is at the pylorus; here it consists of an annular ring of thickened fibrous tissue, which gradually closes the canal, and at the same time forms a distinct tumour. Its treatment has already been considered. Fibrous stricture in other parts of the intestinal canal is the result of a contraction due to the healing of an ulcer, and it differs from the pyloric variety of fibrous stricture in that it is not circular. When there has been a history of dysentery, followed by slowly increasing symptoms of obstruction, one would expect to find one or more contractions in the large intestine, or possibly in the ileum. The stricture caused by a syphilitic ulceration will usually be in the rectum, while that due to tubercular disease will be situated about the cæcum.

Another form of cicatricial contraction, and one which is more likely to be circular, is that which follows injury to intestine which had been damaged at the time of an invagination resulting in a spontaneous cure after sloughing, or following the injury which may be received when a piece of bowel has passed into a hernial sac, and which has not been so far destroyed as to prevent an apparently successful primary operation. When there is a history of this kind followed by symptoms of obstruction, the diagnosis is likely to be easily made.

Malignant disease of the intestines is most commonly found in the rectum. It is almost invariably an epithelioma when in this position or in the large intestine. When the disease is situated in the small intestine it is usually of a sarcomatous nature. In cases of carcinoma the disease commences either in the mucous membrane or in the glands; when it is a sarcoma, its origin is in the connective tissue of the wall.

Chronic obstruction may also be caused by the presence of a tumour in such a position that the gut is caught between it and some fixed point. This is more likely to be found in those parts of the intestinal tract where there is little movement, and the growth is likely to be of such a size that the probable diagnosis is by no means difficult. Such a condition is much more likely

to occur in women, for the reason that tumours are more common in them ; but it is wonderful how easily the bowel seems to accustom itself to being displaced unless the tumour has suddenly altered its position.

Non-malignant tumours in the interior of the bowel are usually polypi growing from the mucous or submucous tissue ; or more rarely the growth may be a cyst. A polypus or pediculated adenoma is not usually large enough to form a complete obstruction ; it is more likely to be the cause of danger by becoming the exciting cause of an invagination. The diagnosis of the presence of a tumour inside the intestine might be made, but usually it is only discovered after the abdomen has been opened on account of symptoms of obstruction. Cysts as a rule act by completely blocking the lumen of the gut.

An accumulated mass of fæces is usually met with in the large intestine, and as a rule either in the cæcum or at the sigmoid flexure. This condition seems to be due to some prolonged over-distension of a part of the intestine. The result of the long-continued presence of a fæcal mass is that inflammation is set up, and eventually an opening through the bowel may be formed. The symptoms not infrequently resemble those of malignant disease, and there may be alternating attacks of constipation and diarrhœa. A very distinct and well-defined tumour may be felt.

Diagnosis.—The differential diagnosis of chronic obstruction, due either to a simple cause or to malignant disease, will be made by considering the previous history of any condition which may have left behind an injury of the intestine ; and by the deterioration in the general health being more marked in malignant disease, while the abdominal symptoms are less noticeable. The position where the obstruction seems to be situated, and the presence or absence of a tumour, will also prove of assistance. The importance of making a diagnosis of what is the cause of a chronic obstruction is that it enables us to give a more correct prognosis than would otherwise be possible,

for in the one class we can hold out the certainty of a complete recovery if the operation be successful, while in the other it is at least very unlikely that a permanent cure can be effected. In cases where the disease is not malignant, and where there is a history of one of the conditions which may have given rise to cicatricial contraction, and more especially where there have been one or more attacks of acute obstruction, it is advisable not to wait until the life of the patient is endangered by an absolute block; but we are justified in advising an operation when the patient is in fairly good health, unless there be any special reasons which contra-indicate the performance of any serious operation except as a last resource.

Treatment.—When an acute attack threatening to prove fatal is superadded to the chronic condition of partial obstruction, the operation that will have to be performed does not differ from that which is required when there is no history of gradual diminution in the lumen of the gut. The indications for operation, and the exact line of treatment to be followed, will be determined without reference to the previous chronic obstruction. When there is a contraction caused by the healing of a cicatrix, the continuity of the intestine should be made by lateral anastomosis by means of bone plates. This is undoubtedly the proper course to pursue, and the only special precaution is, one must be certain that there are no other strictures present due to the same cause, before the incision in the bowel has been made and the bone plates stitched into position. Under every circumstance this ought to be better than excision; and as long as there is not an absolute and permanent obstruction, there need be no fear of marasmus even should the bone plates be situated some feet apart.

The treatment of a sarcoma of the small intestine is not likely to be satisfactory. If the diagnosis of the presence of such a growth be made, no operation should be undertaken, because, as the disease advances quickly, infiltration of the surrounding tissues is almost certain, and it is therefore nearly hopeless to expect to be able to remove the whole of the disease.

Even if this were done there would be a quick return. If, however, this disease be found during the performance of an operation for acute obstruction, a lateral anastomosis by means of bone plates may be made; or if the disease be situated far down in the ileum, the proximal end of the intestine may be fixed in the wound. This will give the patient a chance of getting over the acute attack of obstruction, and may prolong his life for a more or less short period of time.

In cancer of the large intestine, which is too high up to be removed from below, the progress of the disease is often very slow. When a well-defined tumour can be felt and a diagnosis of cancer has been arrived at, and when there does not appear to be any surrounding infiltration nor infection of glands at a distance, and if in addition the health be fairly good, an operation should be proposed to the patient. The intention of this operation will be to remove the whole of the disease, and then to close the divided ends of the intestine and make a lateral anastomosis, or to bring the ends directly together by circular stitching. This certainly goes against the fundamental general principle that it is useless to attempt the removal of a cancerous tumour unless the whole organ in which it is situated be taken away. But, as the surgery of the abdomen differs in some respects from general surgery, it may be that this sound surgical principle need not be carried too far in the case of a slow growing carcinoma of the intestine.

Before the operation is determined on, the alternatives which the patient will have to face if the disease cannot be entirely removed must be put before him, and the general decision as to what is to be done ought to rest with him. These alternatives are either a lateral anastomosis by means of bone plates, a colotomy, or closure of the wound, nothing having been effected.

When a lateral anastomosis can be made, this is the proper course to follow. It may not be possible, and in such a case colotomy may prolong the life of the patient by preventing the irritation from the cancerous stricture; but the patient might

prefer that the wound should be closed if the obstruction be not giving much trouble, leaving the opening into the bowel to be made when it becomes absolutely necessary. The difference between lateral anastomosis and colotomy is, that in the first the diseased part is put at rest, and the operation thus gives all the advantages which may be derived from a colotomy ; and at the same time it does not offer the disadvantage of having the end of the intestinal canal in a novel situation.

When there is a tumour inside the intestine, a longitudinal incision must be made along the convex surface of the gut either above or below the swelling, large enough to allow of the removal of the growth and the ligature of its pedicle after it has been transfixed. The incision in the gut is then closed in the usual way with a continuous silk suture. If the intestine be found to be gangrenous, it is to be dealt with in the way described in the treatment of acute obstruction.

The treatment of fæcal impaction consists chiefly in injections, as of bicarbonate of soda and water, syrup and water, etc. These injections are to be put up slowly, and retained as long as possible. Attempts may be made to tone up the wall by the administration of strychnia, and the use of the faradic and galvanic currents, and well-applied massage.

Colotomy.

By colotomy is understood the formation of an artificial communication between the colon and the surface of the body. The operation may be performed through the flank, or in the inguinal region on either side. The first is commonly known as lumbar colotomy or Amussat's operation, and the other as the operation of Littré. Until within the last few years lumbar colotomy has been the operation which was practically always performed. The old fear of the peritoneum was the chief factor in the choice of the lumbar operation, it being supposed that the colon could always be reached from behind without having to

open the peritoneal cavity. It is now known that both at the sigmoid flexure and at the ascending colon the large intestine is in a certain proportion of cases not only entirely surrounded by peritoneum, but is also provided with a mesocolon, and observations show that this is rather more likely to be the case in the left than in the right side. With the amount of distension of the colon, the number of cases where the operation can be performed without opening the peritoneum will vary; the greater the distension the more frequent will this be possible.

As the great dread of the peritoneum passed away the older operation of Littré began to be practised. It differs from the lumbar colotomy in this, that the peritoneum must be opened, and that the intestine must be stitched to the abdominal wall in front.

One of these two operations is performed either for the purpose of putting the lower part of the bowel completely at rest, or to prevent a fatal termination in the presence of obstruction in the large intestine. The first of these purposes is carried out either with the object of effecting a cure, or, when the disease is of a malignant character, with the intention of giving a patient ease and prolonging life, by removing a source of irritation. The cases where we may expect a cure are those where there is either ulceration of the rectum, or excessive distension of the colon, or where a non-malignant recto-vesical fistula is present. In addition to these, Littré's operation may require to be performed in some cases of volvulus, intussusception, or other forms of intestinal obstruction.

In severe cases of ulceration of the rectum, where the disease has resisted all treatment, and where it seems to be evident that the ulcerated condition is prevented from healing by the irritation due to the passage of fæces, both directly and by reflex action, the opening of the bowel above the seat of the disease will give complete rest, and may thus allow the ulcerations to heal. The opening will be made usually on the left side, or on the right occasionally if there be any reason to suspect that the

ulcerations are high up in the descending colon; and especially if in addition there be excessive distension of the colon. It may be that the operation will become necessary for this latter condition alone when purgative medicines, enemata, and the use of electricity have failed, and symptoms of intestinal obstruction are threatened. With a two or three months' rest the colon becomes contracted, returns to its normal size, and recovers its muscular power.

In cases of recto-vesical fistula an attempt may be made to allow the fistulous opening to close, or to give relief from distressing symptoms by emptying the bowel above, and thus preventing the passage of fæces into the fistula. The alternative to this procedure is resection of the bowel, an operation which entails a considerable amount of danger; and as a general rule the simpler operation of colotomy will be preferred. In such cases colotomy does not offer an absolute certainty of success; but should it fail resection can be resorted to later, and it is well that the patient should be told before the first operation that the simple colotomy may result in failure. It will be impossible to tell beforehand for what length of time the external opening in the colon will have to be kept open; but in any case it must not be closed until all bladder symptoms have subsided, and have been absent for several weeks.

The suffering due to malignant disease of the rectum can be relieved in many cases by removing the constant irritation which is caused by the continuous passage of fæces. This gives not only relief, but prolongs life, as the disease advances more slowly when it is allowed to lie quiescent. It is impossible to estimate the amount of time which is gained by the operation, it will depend in large measure on the stage to which the disease has progressed; but in any case the end comes more easily and with less suffering. If it were not that the discomfort and misery resulting from the opening of the bowel, either in front or behind, is always present, Bryant's suggestion that the disease should be put at rest as soon as it is discovered, if it

cannot be entirely removed, would be a very proper line of treatment to adopt. One can hardly advise this plan in the circumstances. To have an artificial anus prevents any one, almost invariably, from living like ordinary people; and this being so, some very definite advantage must be expected before the patient can be advised to undergo the operation of colotomy for malignant disease. Undoubtedly there are numerous cases where the operation is perfectly justifiable and right, but it would be difficult to realise that one would consent to have an artificial anus made in oneself unless it were with the expectation of gaining some definite relief from suffering. Ultimately, the decision must rest with the patient, and as a rule it will be given against the performance of the operation unless the disease be giving rise to great distress and misery.

When there is actual obstruction of the colon, colotomy ought to be performed to save life. Volvulus at its common situation at the sigmoid flexure may have to be treated in this way, if untwisting or lateral anastomosis by means of bone plates cannot be effected. This is by no means a satisfactory termination to such an operation, and it ought never to be the operation of election. Colotomy will also be performed to save life in cases of imperforate anus after an attempt to reach the bowel from below has failed; and for this purpose Littré's operation is to be preferred, as it is impossible to say that the colon will be present in the loin. So uncertain is the position of the intestine that in such a case a median incision will be probably most satisfactory, more especially as the artificial anus is intended to be kept open, only until another attempt can be made to open the bowel in the ordinary position.

The mortality of the operation is not very great, whether the lumbar or Littré's be performed; but as it is usually undertaken for malignant disease, and when the patient's strength is spent, the mortality, as shown by statistics, is greater than the severity of the operation ought to justify. The choice of the operation will vary much with the surgeon; there is not much

to choose between the two, and the lumbar will usually be preferred by those who are not accustomed to abdominal work, the operation being rather more simple, especially when the posterior surface of the colon is unprotected by peritoneum, and this is usually the case. The disadvantages of this operation lie in the anatomical relations of the colon, and also in the fact that the wound is deeper, and that there is therefore more danger of infiltration into the divided tissues with resulting septic absorption.

The Operation of Lumbar Colotomy.

For the purpose of obtaining as much room as possible between the ribs and the ileum—a space which in exceptional circumstances may measure little more than an inch—the patient is to be placed on his right side and a firm pillow is put underneath the loin. As in all other operations, the patient must be well covered up, with a hot bottle to the feet, and as little of the body as possible exposed. The skin is thoroughly purified, and the incision is made either transversely or obliquely. The guide to the position of the bowel is the edge of the erector spinæ, and the incision, when the left side is being operated on, is to be commenced slightly behind this muscle, midway between the crest of the ilium and the ribs, if the incision is to be made transversely; or nearer the ribs if it is to be oblique, the amount of obliquity being determined by the configuration of the patient. When the intestine is being opened on the right side the incision begins in front and ends beyond the erector spinæ muscle. It is prolonged forwards and downwards for from two to four inches, the length depending on the thickness of the abdominal wall. In cutting towards the bowel only one surgical landmark need be borne in mind, and that is the border of the erector spinæ, the incision being continued onwards until the subperitoneal fat is reached. To do this easily and in a direct line, forceps on each side of the wound must be

used to prevent any deviation. When the subperitoneal fat is reached, the deeper layers of the wound are divided to the full extent of the external incision if there be any difficulty in finding the colon. When the colon is distended with fæces or with gas there is no difficulty in recognising it. Should it be empty and not easy to find, it may be distended from the rectum with hydrogen gas or air blown in by a bellows, though this is scarcely necessary. The mistake which is usually made is in not keeping the straight line to the bowel with the forceps, the tendency being to reach the peritoneum too far forward, with the result that the abdominal cavity is likely to be entered. When this accident happens, the opening should be closed at once either by drawing it forwards with forceps and surrounding it with a circular ligature if small, or if large by an interrupted suture, bringing peritoneal surfaces together. Before this is done the finger should be passed into the cavity and the exact position of the colon determined. If the bowel be not distended, or if a mesocolon be present, the peritoneum may have to be separated to allow of the opening into the gut being made. Before the bowel is opened, it is drawn forward as far as possible with the pedicle forceps, and gauze, soaked in the carbolic and glycerine solution, is packed into the wound between the bowel and the raw surface to prevent any soiling of the cut surface. The incision into the gut itself is made transversely when the operation is performed for malignant disease, and longitudinally when it is proposed to close the gut at some future time. Should the colon be filled with hardened masses of fæces, considerable difficulty may be found in getting rid of them, and a great deal of ingenuity has often been required to effect their removal. A bent teaspoon will often prove of service. When the bowel has been emptied, the gauze is removed, and sutures are passed through the ends of the external wound, but are not to be tied until the gut has been secured. The opening in the gut is then stitched with interrupted silk stitches, each passing through the superficial parts of the external wound and

the whole thickness of the bowel. The angle formed by the drawing up of the colon directs the fæces towards the outside. The dressing should consist of large antiseptic pads of some absorbent material well sprinkled with iodoform, and for the first day or two covered with a piece of jaconet to prevent the discharge soaking directly through the dressing, which is kept in position by a single broad bandage round the body. The position of the patient after the operation is of little importance, probably on the back is the best; but the secret of giving comfort lies in the frequent changing of the dressing, for otherwise the skin becomes sodden and irritated. The stitches need not be removed until they begin to cut out, and after the wound is firmly healed the patient may use his ingenuity in devising some means of temporarily closing the opening. A hollow rubber pad distended with air and kept in position by a flannel bandage is likely to do as well as any of the more complicated appliances, but the rubber requires to be frequently renewed. When trouble arises from the passage of fæces into the bowel below the opening, the lower orifice may be partially closed with sutures, the bowel being first invaginated as much as possible, and at the time of the operation sutures should always connect the skin and the angles where the bowel has been divided, so as to draw the gut upwards and make the angle very acute. The bowel below the opening must be washed out daily with some warm non-irritating antiseptic fluid.

When the operation has been performed for simple ulceration of the rectum, it is rather an advantage not to have much of a spur when the bowel is fixed in the wound, and when the opening has been made in a longitudinal direction it may close itself without any operative interference. Should an operation be required to close the opening in the bowel, the surrounding adhesions are to be gradually and carefully broken down or divided with scissors to allow of the colon sinking back towards the abdominal cavity, and thus permit of the passage of the

fæces in the direction of the rectum. If this simple plan fail to effect the closure of the artificial opening, the divided edge of the bowel will have to be refreshed and a few stitches put in, the lumbar wound being then allowed to granulate over.

Littré's Operation.

Littré's operation can be performed on either side, though the original operation was on the left. It commonly goes by the name of inguinal colotomy, and this name describes the condition very correctly, as it is not advisable to make the opening in the middle line except perhaps when operating for imperforate anus. The exact site of the incision varies with different operators, some prefer to make it parallel to Poupart's ligament, an inch or an inch and a half above, commencing a little to the inside of the crest of the ilium, the length of the incision being not less than two, and not more than three inches. Others prefer to make a vertical incision through the left linea semilunaris. It does not seem to be of very much importance whether the oblique or the vertical incision is used. The peritoneum is reached, drawn up with forceps, opened, and other forceps are fixed on to it to prevent its separation during the future manipulation.

Two fingers are passed into the cavity, the colon is drawn up into the wound and examined for the longitudinal striation, to be certain that a piece of small intestine has not been taken hold of. The colon is then drawn out from above, the lower end being pushed in as this is done, until the mesenteric attachment of the bowel is flush with the centre of the wound. It is advisable to do this to reduce the risk of future prolapse. Very various methods of fixing the bowel in the wound are used. The principle on which this is done will depend on whether it is expected that the continuity of the bowel can be restored later, or whether the artificial anus is to be permanent.

When there is no expectation that the opening will be

closed, the object is to afford as free a passage as possible for the intestinal contents to the outside, preventing at the same time their passing into the lower part of the intestine. This is to be managed by flexing the bowel as acutely as possible, thus making what is technically known as a spur. The bowel, being kept well forward, is to be opened if there be immediate hurry for doing so, the incision being made in a longitudinal direction for from one to two inches if the disease be not of a malignant character.

When it is malignant the bowel is to be divided transversely to the extent of nearly half its diameter, and this can be enlarged later if the fæces tend to pass into the lower part of the intestine. Before the bowel is opened, a small sponge attached to forceps or a piece of silk is passed into the abdominal cavity, and the wound and bowel are well surrounded by gauze to prevent the possibility of infection of the peritoneum. The contents are then emptied out, and the gut is closed above, either by the finger and thumb of the assistant, or with a clamp or rubber band.

In the angle or V caused by the flexure of the bowel, and near to the mesentery, several fine silk sutures are to be introduced connecting the one side of the V to the other, to increase the acuteness of the angle. Interrupted stitches are then to be passed through the abdominal wall, taking a firm hold of the peritoneum, and then through the bowel, coming out at the opening. By taking in a good part of the peritoneum the bowel can be brought near the surface of the wound. At each angle one or two stitches are passed through the wall on one side, through the bowel, and then they transfix the wall on the other side so as to keep the angles in close apposition to the abdominal peritoneum; and assistance will often be given in doing this if the peritoneum has not been opened to the full extent of the wound. Should the incision have been made too long it must be reduced in size as usual by silk stitches.

The dressing is the same as in the lumbar operation, and the

after treatment differs in no detail from that of any other abdominal operation. The stitches are quite enough, as a general rule, to support the bowel; but if there be any fear of their not being sufficient, a modification of the operation, as described by Maydl, may be performed. A hard rubber cylinder covered with iodoform gauze, or any rigid bar about the size of a goose quill, is passed through a hole made in the mesentery close to the bowel, and the ends of the cylinder resting on the skin on both sides of the wound prevent the bowel from slipping back into the abdominal cavity. The two legs of the drawn out piece of bowel are stitched together on both sides below the cylinder, the sutures not passing through the whole thickness of the intestinal wall. When the bowel is to be opened immediately the edges of the opening are stitched to the skin. When a delay of four or five days can be afforded, iodoform gauze is packed round the gut and underneath the supporting bar; adhesions soon form, and the gut can be incised before the end of the week. When the case goes on well the bowel which has originally been opened to the extent of half its circumference may be completely divided in a few weeks, the bar serving as a useful guide. When this is done, a few stitches will connect the intestine and skin together. When it is desired to close the opening in the bowel, the bar is withdrawn, the bowel is allowed to sink downwards, and the opening may close of itself, or it may be necessary to separate adhesions and close the intestinal opening, after which the gut is passed back into the peritoneal cavity. The operation lends itself to a great variety of minor modifications, but so long as the intestine is so fixed in the wound that there is no septic infection, and the fæces pass easily to the outside, the exact procedure is not of any consequence.

Before deciding whether Littré's or Amussat's operation is to be performed, the advantages and disadvantages of both must be considered in reference to each particular case. In acute obstruction, one can never say with certainty that by opening the colon in either the right or left loin one will be above the

seat of the obstruction, even when a chronic condition predisposing to acute obstruction is known to be present in the large intestine. In all such cases Littré's operation is the one to be adopted, either primarily or after the obstruction has been searched for through a median incision. The same operation is to be performed for imperforate anus, with the modification in this case that the median instead of the inguinal incision be adopted. For putting the rectum and colon at rest either of the operations may be chosen, but unless the patient be very stout the lumbar colotomy is the more easy and the more safe.

The discomfort of the patient after any operation where an artificial anus has been made is lessened often in a very marked degree by the administration of charcoal in the form of lozenges. This helps to keep the contents of the bowel firm, and at the same time prevents disagreeable odours.

When treating of surgical diseases of the stomach, an operation was described which might save the life of a patient after rupture of a gastric ulcer. Somewhat similar ulcerations, and ulcers due to other causes, occur in the intestine. These consist of ulcerations of the duodenum resembling a gastric ulcer, or in this situation they may follow after an external burn. Ulceration may occur in the course of typhoid fever, dysentery, tuberculosis, and syphilis. Ulceration may also result from the irritation of a fæcal impaction, and the bowel may give way after the reduction of a hernia.

In any of these cases ulceration may go on to rupture. During the course of any of these foregoing conditions or diseases, when sudden symptoms of collapse accompanied by severe abdominal pain come on, it is probable that a rupture has taken place, and if the general condition previous to the time of rupture has been fairly good, the propriety of an exploratory abdominal operation may be considered. When it is evident that the perforation is the "last straw" in the course of the disease, any operation is entirely out of the question.

When operation has been determined on, the abdomen is to

be opened in the middle line, and that part of the intestine is first examined which is usually the seat of ulceration—viz. in typhoid fever, the large intestine or lower part of the ileum; in dysentery, the large intestine ; in tubercular disease, about the cæcum ; in syphilis, about the sigmoid flexure and rectum.

Injury of the Intestine.

These result either from gunshot wounds, stabs, or injuries such as a kick or fall ; and in all, success is likely to follow early operation, while if it be delayed even a few hours, the successful cases will be much less numerous. A gunshot wound of the abdomen does not necessarily mean perforation of the intestine. In judging whether the peritoneum has been injured we have to take into consideration the direction from which the bullet was fired. It may be difficult to get any definite information concerning this, and we may have to draw our inference on the subject from the appearance of the external wound. A bullet striking the abdomen at right angles will give evidence that it has done so by the equal appearance of injury or bruising round the opening; while if it has struck obliquely the bruising will be irregular, and the opening will probably be not so clean cut. As cases are on record where a bullet has passed round the abdomen without injuring the peritoneum, there seems to be no valid reason why a probe should not be passed gently into the wound. In the hands of an educated surgeon the instrument can surely do no harm, and it may give a positive indication whether the peritoneum has been opened or not. The one certain symptom of perforation of the intestine will be the appearance of the contents at the external opening. This is unfortunately seen only in rare cases. When the case is seen early, the symptoms will be chiefly those of collapse due to the shock, and possibly also to hæmorrhage. If not seen for some hours, the shock will have passed away as a rule, and there will be evidence of peritonitis, probably of a septic character.

Treatment.—In every case where the peritoneum has been injured by a bullet the abdomen should be opened without waiting for symptoms, unless the shock be very profound and apparently not due to hæmorrhage. In such cases, almost more than in any other, every care must be taken to keep the patient warm, and the perforated rubber sheet must be employed, partly for this purpose, and partly to keep him dry, as the peritoneal cavity is certain to require washing out. The incision ought to be made, as a general rule, in the middle line. From this position all parts of the abdominal cavity can be reached, and an investigation of the exact injury more easily made. The incision must be a free one, certainly not less than will easily admit the whole hand. As soon as it has been made, the peritoneal bullet opening must be examined in case there should be bleeding; and if there be much blood in the peritoneal cavity it must be cleared out, and its origin searched for and secured. While this is being done, an opening may be discovered in the intestine, and if so it must not be allowed to pass out of sight, and it is to be stitched up in the following way as soon as the bleeding has been arrested. The edges are cut smooth if necessary. The direction of the line of union should be in the transverse diameter of the bowel, so as to prevent constriction. A continuous suture is to be used as described in the operation of gastrorraphy; a few interrupted sutures, or another layer of continuous ones, may be inserted to give support. If no other openings have been seen while searching for hæmorrhage the intestine should at once be distended, according to Senn's plan, by the insufflation of hydrogen gas from the rectum. With the coils in sight it will be easy to notice whether there is any leak, although its exact position may not be discovered until the gas has been ignited after the coil of intestine has been drawn outside the wound. The flame can be extinguished by placing a damp sponge on the opening. This rent is closed as before, and the distension is continued until the whole of the intestine has been examined, unless the condition of the patient be too

bad to allow of this amount of manipulation. When the distension is found to interfere very much with the examination of the upper part of the bowel, the insufflation from the rectum might be stopped, a long tube passed through the sphincter ani to allow the gas to escape, and the upper part of the gut distended by the hydrogen which is passed in through the wound opening, the assistant preventing the backward flow of the gas. The abdomen is then thoroughly washed out with warm water at a temperature about 100° F., and this may be done by the assistant while the surgeon is closing the perforations. A drainage tube, where there has been extravasation of the contents of the bowels, must always be used. The median wound, and the one made by the bullet, are closed in the usual way.

The great dangers are shock and septic peritonitis, and stimulating enemata will be required as soon as the patient is put back to bed. In cases where there is injury to the mesentery, possibly sufficient to stop the blood supply to the bowel, the fear of gangrene will make it desirable to make a resection of the gut, the injured part of the mesentery being removed in a V-shaped manner. The chance of recovery in a case of this kind is very small, and when the operation is a prolonged one, several openings having to be closed, it might be better to draw the part of the bowel whose mesentery has been injured into the parietal wound, and to fix it there by passing a quill covered with iodoform gauze under the bowel, while the rest of the wound is packed with gauze so as to shut off the peritoneal cavity. If the bowel remained healthy the quill and gauze could be removed at the end of a couple of days; if it sloughed, an artificial anus would be formed, and this could be operated on at some future time.

Puncture Wounds of the Intestine.

The treatment of puncture wounds of the abdomen does not vary from that of those inflicted by bullets, but in an injury

from such a cause the intestine is less apt to be wounded, for, being more or less non-resisting, it may be pushed aside by the cutting instrument. It is more likely to be injured when the gut is distended than when it is in a collapsed condition; but as it ought to be a recognised practice to open the abdomen in all cases where there is a penetrating wound of the abdominal wall, an opportunity will be given for examination, assisted by distension by hydrogen gas. The injury inflicted by a knife, pitchfork, etc., is likely to be a less severe one than when the abdomen has been perforated by a bullet. The treatment is the same, either suturing the opening or openings, resection, or the formation of an artificial anus if the mesentery be much injured. The after treatment is similar to that which has been recommended in operations on the stomach and intestines; most of the nourishment, however, is to be given through the rectum for the first few days. The enemata are to be diluted as largely as possible, if thirst, which is likely to be a prominent symptom, is more distressing than usual.

Rupture of the Intestine.

Rupture is of necessity a fatal accident if the opportunity be not given to close the opening by sutures. This accident may be caused either by direct or indirect violence, as a blow, a kick, a fall, being run over, or coming forcibly against a bar, are examples of the former; a fall on the back of the latter. The symptoms come on at once, there is collapse usually of a very severe character; as the patient comes out of the collapse, pain sets in of such a severe nature that it is usually necessary to give a large dose of morphia before any examination can be made. There is nausea and vomiting, restlessness, retention of urine, and other symptoms which commonly follow cases of severe injury. The situation of a rupture caused by direct violence is usually in that part of the small intestine which is least movable, excepting only the duodenum, the most fixed

part of all, because it, like the large intestine, is well protected. Rupture due to indirect violence is usually found in the duodenum. The actual injury to the bowel is of the nature of a contused or lacerated wound, and more or less evidence of this will be seen surrounding the opening in the gut when the abdomen has been opened. This bruised condition of the bowel has to be borne in mind when we come to the treatment, and a bruised and injured state of the mesentery must also be expected.

Symptoms arising from a case of bruising of the abdominal contents, especially if the injury be in the upper part of the abdomen where so much of the sympathetic nervous system lies, are very similar to those where an actual lesion of the bowel has taken place. To distinguish between these two conditions, when the case is seen before there is much distension, an attempt should be made to make a diagnosis by distending the intestine by hydrogen gas. If the gut be intact the intestine will distend gradually from below, and will finally reach the stomach; when there has been a solution of continuity, the distension will be more general, and the edge of the liver will be lost much more early, as is described by Senn. There is one special source of fallacy, and that is, that a rupture high up in the small intestine would not allow of the appearance which is due to the passage of the gas into the peritoneal cavity, for the abdomen would be already well filled with the distended coils.

Treatment.—When the diagnosis of rupture is made, treatment should follow immediately; the abdomen should be opened in the middle line, when probably a mixture of blood and the contents of the intestine will have to be removed either by sponging or by washing out with warm water before any examination can be made. The arrest of the hæmorrhage must be the first thing to be attended to. When this has been accomplished the nature of the injury to the bowel will be investigated, but in any case it is probable that the best hope of saving the life of the patient will lie in the immediate formation of an artificial anus, the

whole of the bruised part of the intestine being fixed in the wound as in the manner described in Littré's operation. If the patient recover from the injury, the continuity of the intestinal tract can be renewed later. This method seems to give a better chance of success than resection. A simple stitching up of the rent in the bowel is not likely to be often successful on account of the bruising which is certain to be present, even although there may not be much evidence of it at the time of operation. So far, we have treated the condition as if the bowel had been injured at one point only. Should, unfortunately, there be several ruptures, it is almost certain that the patient will die. In such a case it would probably be better to suture the openings immediately, unless the bruising were very marked or the mesentery much injured, as much of the edges of the gut being turned in as can well be managed. Any specially badly injured portion can be fixed in the wound. What seems best at the moment must be done, but in any case the friends must be warned that they may look for an almost certainly fatal result.

In every case of rupture the abdominal cavity is to be thoroughly washed out, and a drainage tube introduced to drain the cavity from the bottom.

An interesting example of the necessity of leaving nothing to chance, of never giving up hope, and saying the injury is too severe and nothing can be done, is illustrated by the history of an accident which occurred about fifty years ago on a ship in the arctic region. In this case, although the intestine was not actually ruptured, the knowledge of abdominal surgery was so slight, that comparatively the chances of recovery were as small as if a rupture of the intestines had occurred at the present time. Two whalers were blocked in the ice some distance apart, a sailor fell from the rigging of one on to the deck, severely rupturing the abdominal wall, through which there was a large protrusion of the intestine. The "doctor" on board, a second-year medical student, not knowing what to do, sent over for assistance from the other ship. This "doctor" took the common-

sense view that the prolapsed intestine should be washed, put back into the abdominal cavity, and the laceration in the abdominal wall closed by stitches. During the night the ships separated, and the "doctor" on the second ship heard nothing more of the case until he reached home. As he landed on the pier at Peterhead several sailors who were lounging about raised a cheer, and one of them came forward and told him that he was the patient whose belly he had sewn up!

CHAPTER VIII.

THE APPENDIX.

An inflammation situated in the right iliac region has long been known under the names of typhlitis and perityphlitis, the terms representing either an inflammation in the cæcum or in the tissues round about it. But the names were used very indefinitely, and it came to this that a typhlitis or perityphlitis signified an attack of inflammation either with or without perforation of the bowel somewhere in the right iliac region. Classifications of various kinds have been made, founded more on opinions than on exact pathological conditions; and, although the pathology has now been very much cleared up, the tendency is still to make classifications which will not bear the test of bedside examination, and which tend to confuse rather than to simplify the study of this diseased condition.

As the name implies, appendicitis means an inflammation of the appendix, and the disease, which was known under the names of typhlitis and perityphlitis, was in reality an inflammation of the appendix, at least in the great majority of cases. In the present state of our knowledge we are not prepared to say positively that such a disease as a simple typhlitis or perityphlitis can never exist without the appendix having been inflamed; and in one instance we have seen strong evidence that such might be the case, though the history was not rendered complete by a *post mortem* examination. This disease has become of the very greatest importance in abdominal surgery. It seems that, as

with every new thing, the pendulum has swung too far towards operation, and that the time is coming, as it has already come in the operation for the removal of the ovaries, that a definite stand must be made against the indiscriminate removal of the appendix vermiformis. One firm of instrument makers in New York is reported to have made to order six dozen trusses for ventral hernia, following the removal of the appendix, during the first six months of 1893! Even if this meant carelessness in the closure of the wound in every case, it surely indicates a number of unnecessary operations; and it is probable that many of the patients would gladly have back their appendix if they could get rid of the hernia.

Surgical Anatomy.

According to Quain, the position of the cæcum and appendix is as follows: "The cæcum is situated in the right iliac fossa, immediately behind the anterior wall of the abdomen. It is covered by the peritoneum in front, below, and at the sides; but behind, it is usually destitute of peritoneal covering, and is attached by areolar tissue to the fascia covering the right iliacus muscle. In this case the cæcum is comparatively fixed, but in other instances the peritoneum surrounds it almost entirely, and forms a duplicature behind it, called meso-cæcum. Coming off from the inner and back part of the cæcum, at its lower end, is a narrow, round, and tapering portion of the intestine, named the appendix cæci, or appendix vermiformis. The width of this process is usually that of a large quill, or rather more, and its length varies from three to six inches, these dimensions differing much in different cases. Its general direction is upwards and inwards behind the cæcum, and after describing a few slight turns it ends in a blunt point. It is retained in its position by a small fold of peritoneum, which forms its mesentery. The cæcal appendix is hollow as far as its extremity, and its cavity

communicates with that of the cæcum by a small orifice, sometimes guarded by a valvular fold of mucous membrane."

The appendix does not seem to be of any use in the economy of man, and its removal does not give rise to any disturbing symptoms. Its structure is the same as that of the large intestine, and its mucous membrane contains glands which give off a mucous secretion. In length it varies very considerably, it may be almost entirely wanting, or it may measure as much as eight or nine inches. The reduplication of the mucous membrane situated in the cæcum at the origin of the appendix is to be specially noticed, as its presence or absence may have something to do with preventing or causing attacks of inflammation. The point where the appendix comes off from the cæcum is recognised as being situated at a spot midway between the umbilicus and the anterior superior spine of the ileum ; but as the cæcum is capable of relaxation and distension this spot cannot be an absolutely fixed one.

The position of the appendix in the body varies very considerably, and the different positions which it takes up are of importance when surgical interference is required, as the situation of an abscess resulting from perforation of the appendix will depend on the position of that tube. The different positions in which it may be found are downwards, inwards, upwards and to the outer border of the cæcum, upwards and to the inner border, upwards and very much behind. It is therefore evident that the appendix may be found in any relation to the cæcum, and it is necessary to know this both when making a diagnosis and when performing an operation. In other words, the appendix may be so situated that a rupture may set up either general peritonitis or inflammation of the cellular tissue behind the peritoneum.

In addition to what may be called the natural positions, the appendix may be fixed by adhesions in almost any part of the abdomen. The exact relation of the peritoneum to the appendix requires further consideration. In the description quoted from

Quain, it is mentioned that the appendix is provided with a mesentery, and this undoubtedly appears to be the general rule, the tube being therefore free in the abdominal cavity with the exception of this connection. In a minority of cases it is certain that the appendix is not entirely surrounded by peritoneum, but is in direct connection for a part or the whole of its length with the subperitoneal tissues. This explains how it is possible for a rupture to take place directly either into the peritoneal cavity or into the cellular tissue behind.

Causes of Appendicitis.

The causes of appendicitis consist in the result of the presence of a foreign body, such as a cherry-stone, pin, fish-bone, or scybala, in the canal; or the same result may be brought about by a stenosis due to an acute flexion, or a cicatricial contraction. Of these the most common is the presence of scybala. Pointed foreign bodies act as direct irritants, and cause injury on account of their shape. A rounded foreign body found in the appendix, such as a small fæcal mass, probably acts in the following way: having passed into the appendix it either completely blocks the canal, or it sets up so much irritation and swelling of the wall, that a block soon occurs. The vessels then become engorged, mucous secretion is poured out freely, and there is tension in that part of the appendix between the foreign body and the outer end. Should the obstruction not be relieved, the congested mucous membrane pressed on by the pent-up secretion becomes inflamed, suppuration or perforation may result, or the whole of the tube may become gangrenous, the later stages being assisted by the near presence of intestinal microbes. Exactly the same process occurs when the appendix is doubled on itself. In the early stages, if the obstructing cause be removed, the tube empties itself, and resolution takes place. The explanation given by Talamon of the presence of scybala is, that they must be formed in the cæcum, and that they are never made by the

passage of fluid fæces into the appendix. Did the fæces pass into the appendix in the fluid state they would take on the shape of the appendix, for there would not be any room for the round pellets to be formed. In the cæcum a fæcal mass becomes broken up into small pieces, and these become rounded on each other through the peristaltic action of the intestine. The tendency to the formation of these fæcal masses is encouraged by the presence of chronic colitis, and this condition is accompanied by want of contractive power in the wall of the bowel. According to Talamon, the causes predisposing to appendicitis are excess of food, especially if the food be indigestible and highly spiced, thus giving rise to a condition of the intestine favourable to the formation of scybala, namely constipation; irritation, followed by constipation and atony; previous diseases, which affect the colon, or leave it in an injured condition, such as typhoid fever and dysentery, as these certainly favour the production of constipation, and are also apt to leave behind ulceration or inflammation of the mucous membrane.

An ulcer near the orifice of the appendix may cicatrise in such a way that the ingress of a small fæcal mass is favoured while its egress is rendered more difficult. An additional cause of disease of the appendix is tuberculosis, ulceration due to this disease being common in the neighbourhood of the appendix. The disease is more frequent in persons under the age of forty, the most common age being between ten and thirty, and it is more often found in males than in females. It is comparatively rare after forty. A chill following violent exercise seems to be very frequently a predisposing cause.

Pathological Conditions.

To understand the symptoms of this disease, and to form a certain amount of classification, it is necessary to explain exactly what are the pathological conditions which may be set up in the appendix itself, and also those which may follow the rupture

of the tube if the disease be not cured before this stage has been reached.

The pathological stages are: first, simple congestion of the wall with tension due to the retention of the secretion. This results in a simple inflammatory action, which may resolve before any more serious stage has been reached, provided the cause be removed. Second, suppuration may supervene if the cause be not removed, or if the inflammatory action be very acute and septic. Third, gangrene may follow the suppuration. Fourth, the disease may spread beyond the appendix, and the lesion so formed will consist either in inflammation in the peritoneum, or of a suppuration in the cellular tissue.

These pathological conditions will now be considered *seriatim*. When the condition has not passed beyond that of simple inflammation, it may be expected that the disease will resolve, if the foreign body which is blocking the canal passes backwards into the colon or becomes broken up *in situ*. A free drain is thus formed for the removal of the pent-up secretion, tension is relieved, and the appendix returns to its normal condition. This condition may become chronic when the cause is not entirely removed, because a sufficient amount of obstruction remains to prevent the appendix from returning to its natural condition. It must be evident that a condition of this kind may at any time be subject to an acute exacerbation, and this may account for some of the cases known as relapsing appendicitis.

In the second variety the contained fluid has become purulent, and the walls of the appendix are suppurating; this condition may also resolve, if the tube be allowed to drain freely into the cæcum, but it will leave behind peritoneal adhesions, and a more or less damaged condition of the tube itself.

When the obstruction and consequent strangulation is very acute, gangrene may follow in a very short time, and it will either show itself in the form of a complete destruction of the whole appendix, or there may be simply one or more per-

forations. The opening is usually easily visible, but sometimes it may be very minute. When the disease has spread beyond the appendix, towards the peritoneal cavity, a localised peritonitis will be the first result, except in those cases where the appendicular inflammation has been so acute that there has hardly been time for a localised peritonitis, or at least for this peritonitis to form adhesions. The formation of adhesions is to be looked upon as a safeguard, as their presence may limit, for a time at least, the spread of the inflammatory action to the general surface of the peritoneum. The position in which these adhesions will form will depend on the situation of the appendix. At the commencement of the formation of adhesions the appendix need not have ruptured, and if the appendicular inflammation resolve, the localised peritonitis will also probably resolve, unless the patient be imprudent and so run the risk of a chill too early; in this case it is probable that the peritonitis will be lit up afresh, while the appendix may remain unaffected.

When rupture occurs after adhesions have formed, the local peritoneal inflammation will be increased, and an abscess will form within the adhesions in the peritoneal cavity, and yet shut off from it. This abscess may in turn rupture into the intestine, bladder, or general cavity of the peritoneum, and this accident will be followed by an attack of acute septic peritonitis.

When describing the relations of the appendix, we drew attention to the possibility of rupture occurring into the cellular tissue behind the peritoneum. As the appendix is entirely covered by peritoneum in the majority of cases, and as in those in which it is practically sessile and lying in contact with the subperitoneal tissue, the part uncovered by peritoneum is small, it follows that rupture in this position will occur less frequently than in the direction which we have been considering. An abscess resulting from the rupture of the appendix into the cellular tissue may attain to a large size, and its exact situation

will depend upon the position of the tube itself. It may pass deeply into the pelvis, or into the iliac fossa, or behind the cæcum into the back, forming a tumour in the lumbar region, which may extend up to and perforate the diaphragm, causing an empyema. Talamon says: "A forward and inward deviation of the appendix explains those cases where the pus collects above, and to the inner side of the iliac fossa, in the neighbourhood of the umbilicus. Occasionally we may see an abscess evacuated through the umbilicus itself. It seems probable that those cases of encysted suppurative peritonitis, described in children as of spontaneous origin, and terminating by resolution after an evacuation of the pus through the umbilicus, are nothing more than cases of appendicitis belonging to this third class."

Clinical Groups.

Appendicitis in all its phases is to be looked upon as a single disease, but, as the symptoms vary with the severity of the inflammation, and also with the ulterior results of this inflammation, we may for clinical purposes make the following groups:—

First, cases of simple inflammation of the appendix, possibly with suppuration in the walls, which may be cured by medicinal treatment; second, cases where the disease appears to be cured for a short time, but where the apparent recovery is quickly followed by a relapse, because the original cause has not been removed; and third, cases where perforation of the appendix has taken place, with the conditions which follow this accident.

When an appendicitis of the first variety has been cured, it does not follow that the patient will never have a similar attack. When once a hard mass has passed into the orifice, a second may at some future time pass in. A case of this kind is not to be confounded with the second variety, the relapsing appendicitis. In the one case there is so far an absolute cure, as when a stone has been removed from the bladder there is no reason why a

second should form ; while in the other, the relapsing form, the cause of the distress is not removed, it has simply quieted down, and is analogous to the synovitis caused by a loose cartilage in the knee-joint slipping out of position.

The relapsing or second type is caused by the retention of mucus in the tube by a bend due to adhesions; or by partial cicatricial contraction as a result of ulceration ; or it seems possible that a scybalous mass may remain in the appendix, causing a partial block, which at times may become complete ; or there may be a chronic catarrhal condition of the tube, and as the canal is so narrow a slight extra swelling would dam back the secretions, and cause a recurrence of the local and general symptoms.

Inflammation the result of a perforation, the third division, has been already discussed when considering the different positions in which the appendix may be found.

Symptoms of Simple Inflammation of the Appendix.

The commencement may be very sudden, or it may be ushered in by scarcely noticeable symptoms of derangement of the digestive tract. It is met with usually under the age of forty, more commonly in males who are in good health, who are accustomed to live well, and who may have been troubled at times with flatulence. They may have suffered from some irritability of the intestines, especially of the lower bowel, this being shown by the occasional passage of fæces mixed with mucus. In every case the actual onset of a first attack is sudden. The patient is seized with a pain of an acute character in the right iliac region. Accompanying this there will be an attack of colic, the pain being referred to the umbilicus, and there may be vomiting, this latter symptom, however, being due to the severity of the pain. The colic passes away, leaving a dull aching pain in the original position in the iliac region, and at this stage there is constipation due to the paresis following the

acute attack of colic. The onset of the pain in the right iliac region is of a character similar to that of renal or biliary colic, and is to be differentiated from these by the position from which it starts. This position, known as McBurney's point, is situated midway between the umbilicus and the anterior superior spine of the ilium of the right side, and the direction in which the pain passes is backwards and into the pelvis, or towards the umbilicus. In biliary colic, there may be some history of liver derangement, the situation of the pain is over the gall-bladder, radiating through to the back and shoulder, and also towards the umbilicus. In renal colic, the pain commences in the back, and passes downwards towards the bladder, and there may be also symptoms to direct one's attention to the kidney. When a patient is suffering from an attack of renal, biliary, or appendicular colic, he has considerable difficulty in describing in what direction the pain radiates, but he is likely to be able to fix the point where it first started.

The general condition of the abdomen is not to be relied on for the purpose of diagnosis, for, while at first it is usually retracted, later it frequently becomes distended. In the iliac region there will be a decided amount of resistance, due to the spasm of the muscles protecting a tender spot. After the acute attack of pain is over, and the case is progressing favourably, there is little general disturbance ; there may or may not be some slight rise in temperature, but the pulse shows more sign of disturbance. The tongue is coated, the bowels are inclined to be confined, and the patient feels out of sorts. At the end of a week or ten days the patient will have recovered, if the cause of the disease have disappeared quickly, and he soon returns to his normal condition.

Symptoms of Relapsing Appendicitis.

The symptoms of the relapsing form of appendicitis are simply those which are seen in an ordinary acute attack, but, instead of a cure resulting by medical means, a second attack or

relapse takes place within a short time, usually in from one week to two months—the patient now having been thoroughly well in the meantime—and during each acute attack there is nothing peculiar which will differentiate it from a first seizure of this kind. In the interval, there is usually slight dull aching pain in the right side, a tendency to colic and constipation, and the patient is more or less out of sorts. On examination we either find increased resistance, or the dilated appendix may be felt as an elongated mass about the size of a finger. This swelling, however, may not always be made out, as it may easily be situated in such a position that it is too well protected to be come on during the examination.

Symptoms of Perforating Appendicitis.

The cases of this disease must be divided into three clinical types: first, where the onset is rapidly followed by an attack of general abdominal pain, occurring within about forty-eight hours, and due to a perforation communicating directly with the general peritoneal cavity. Second, where the rupture occurs after sufficient adhesions have been formed to prevent a general infection of the peritoneum, and the attack may be cured at this stage, or there may be a second acute exacerbation due to the giving way of the adhesions, general peritonitis resulting. Third, where the rupture has taken place outside the peritoneum, and into the cellular tissue.

Symptoms of the Rapidly Perforating Type.

After the first attack of acute pain is over, the patient feels very much better, except for the dull aching pain in the side; then, within three days from the commencement of the attack, there is sudden relapse, caused by the passage of an active and almost certainly septic irritant from the appendix into the peritoneal cavity. The disease has now passed beyond the appendix, and the symptoms will be those of acute septic peritonitis. The primary result of

this irritation is an attack of violent colic, rapidly followed by a steady pain all over the abdomen, worse perhaps in the right side at the commencement; and there soon comes to be a state of absolute paresis of the intestine. At the very first this is not accompanied by abdominal distension, though this symptom appears later. The bowels do not move, and no flatus passes down, unless the poison be quickly removed by a successful surgical operation. The patient commences to vomit, wind comes up, and there may be hiccough. Everything taken into the stomach is rejected; the vomited matter is at first green, gradually altering in appearance until it is almost black, and the odour is heavy and disagreeable. At first there is considerable straining, later the stomach empties itself almost without effort. Along with this stoppage of the functions of the intestine, the kidneys cease to secrete urine in any quantity; what is passed is of a high colour; no urates are deposited; and the power to empty the bladder may be lost. The skin is harsh and dry, and the sweat glands will not act. There is great thirst, the tongue is bright red or dark brown, and like a piece of dried-up meat. The temperature is generally little over normal, 99·5° or 100° F., and is rarely so high as 102°. The pulse becomes steadily quicker, and as steadily more feeble and wanting in volume. The appearance of the patient is very characteristic, the drawing up of the legs, the restlessness of the arms, the want of expression, all make up a picture that can never be forgotten. Death occurs on the second, third, or fourth day from the time of perforation; very rarely the patient lasts into the fifth day from the time when the rupture occurred. This is a shorter period than some of the descriptions would lead one to believe; but a peritonitis due to rupture must be more or less septic; and when the patient has lived on into the second or third week it is evident that the commencement of the condition was that of rupture within adhesions, and that a second rupture must have taken place through those adhesions, and into the general peritoneal cavity at a later date.

Symptoms of Rupture after Adhesions have formed.

When the rupture occurs at a later period, after the inflammation has spread from the appendix to the surrounding peritoneum, setting up a peritonitis with the usual effusion of lymph, in this way forming adhesions; the result is that the poison does not pass at once into the general peritoneal cavity, but is encysted in a circumscribed part by the peritoneal adhesions, and the pus may remain in this situation without an opening forming into the general peritoneal cavity. The symptoms therefore come on more slowly, and are not so acute. The onset of the attack is the same as already described, the pain becomes fixed in the right iliac region, there is a little general disturbance with some rise in pulse and temperature, and there is usually constipation. The abdomen is not distended. At the end of about a week there is a distinct exacerbation of all the symptoms, caused by rupture having taken place. This is accompanied by a feeling of chilliness, without necessarily an absolute rigor.

At this time the abscess forms, and its presence will be shown by the increase in the pulse and temperature, the latter rising late in the afternoon, and falling in the morning as much as perhaps two degrees. After a few days the very acute symptoms may pass off, or there may be a rupture of the adhesions, followed by acute septic peritonitis. When the pus remains within its adventitious membrane, local examination of the abdomen will show an increased amount of resistance in the right side; and a swelling, the exact position of which will vary with the situation of the appendix. It will at best be not very clearly defined, and it may or may not be felt on rectal or vaginal examination. The want of definition in the swelling is accounted for by the presence of the inflammatory adhesions which have matted together the coils of intestine, and which make up, with the abscess itself, the swelling which is felt. When the abscess does not rupture into the peritoneal cavity, its presence may cause death simply by septic absorption; or it may burrow in different directions,

and give rise to a fatal result by opening into a large blood vessel; or it may open into the intestine or bladder; or the pus may discharge externally. When it opens in any of these directions, except when into a blood vessel, a cure is likely to result after a more or less prolonged discharge. Death may, however, be due to exhaustion, or to the absorption of the putrid discharges.

Symptoms of Rupture outside the Peritoneum.

When the rupture occurs directly into the cellular tissue, the symptoms will be somewhat less marked. Before it occurs there will not have been so much general disturbance as is the case when many peritoneal adhesions have been forming; but in other respects there is not much difference, except in degree; the feeling of chill, the pain, the tenderness in the right side, and the rise in temperature, will all be present. Later, in a case where the pus has come near the surface, there will be some œdema under the skin, and the whole of the cellular tissue of the back, reaching as high as the diaphragm on that side, may become the seat of an abscess.

Diagnosis.—Nothing can be more simple than the diagnosis of a typical case of appendicitis. The suddenness of the onset, the pain in the right iliac region, and the general abdominal and constitutional symptoms as shown by some degree of fever, especially when these all occur in a youth or a man under forty, are, when taken together, so very distinctive, that a mistake as to the nature of the disease would be somewhat difficult to make.

When the patient is not seen until the attack is far advanced, there may be then some difficulty, even in a typical case. The symptoms resemble those of obstruction, and the suddenness of the onset, and other early symptoms, may not have been particularly noticed by the patient or the friends. The more acute the attack, the more easy is the diagnosis. It is necessary to

make a double diagnosis in this diseased condition of the appendix; it has first to be differentiated from an acute attack of intestinal obstruction, and, after a diagnosis of appendicitis has been made, we have to go a step farther, and to make up our minds whether the case is one of simple inflammation without perforation, and therefore curable without operation; or one where a perforation either has already taken place, or is likely to do so, and is consequently a case where medicinal remedies would be worse than useless.

In considering the differential diagnosis between appendicitis and acute intestinal obstruction, we find, in regard to the question of age, that appendicitis is most usually met with between the ages of ten and thirty. In this respect it resembles obstruction due to paresis; but differs somewhat from intussusception, which is more common under the age of ten; and differs in a greater degree from obstruction due to bands, volvulus, and concretions, which are met with, as a rule, in middle life.

In regard to the previous history, the early symptoms are usually so slight in appendicitis, and also in cases of acute obstruction due to every cause, that the onset of the attack is practically sudden in all.

The pain varies in degree, but it is impossible to depend on such a symptom, for no two people feel anything alike.

The situation and character of the pain may certainly help in the diagnosis; in appendicitis, it commences in the right iliac region, and remains in that position, although it may also be spread over the whole of the abdomen; in paresis the pain is general, it is like a very bad colic, and soon passes entirely away; in intussusception, the pain, which is also like colic, gradually becomes worse, and may be more marked at one particular spot, this area of severe pain being situated in any part of the abdomen, but not infrequently on the left side; when the pain is caused by an obstruction due to a band it becomes

general and steady, after being first of a colicky nature, and localised at the umbilicus; while in volvulus it is steady, with periods of very acute exacerbation.

Some little help is given by the condition of the bowels, for in paresis, and in obstruction caused by bands, volvulus, and concretions, constipation is absolute, and no flatus passes downwards, in this way contrasting markedly with the presence of an intussusception, where the tendency is towards diarrhœa, with the passage of blood and mucus. In appendicitis the condition of the bowels is midway between those two conditions; there is usually some difficulty in getting them to move, but flatus passes, and there is no absolute obstruction. When the appendix is inflamed, vomiting may occur, at the commencement; but this is due more to the acuteness of the pain than to any obstruction, and is comparable to the vomiting which may be seen during the passage of a calculus through the bile duct, or through the ureter. It quickly passes off, and is seldom a prominent symptom. It differs also from the vomiting in paresis, for while this is also caused by the acuteness of the pain, it returns as the abdomen distends, and quickly becomes a distressing symptom. This symptom also helps in differentiating a case of intussusception, for here it does not appear in the early stages; when there is a band it begins early, and steadily becomes worse; in volvulus and in concretions its presence will depend on the position of the obstruction.

The amount of distension varies very much in different cases of appendicitis, and also with the exact stage which the disease has reached. At first the abdomen may be retracted, but it is not at all infrequent to find it distended; in comparison with this, distension comes on early in paresis, and there seems to be no limit to its amount; in intussusception, the abdomen is retracted; in volvulus, the abdomen distends early; and when there are bands it comes on more slowly.

A feeling of resistance may be felt in the right iliac region during an acute attack of appendicitis; and, when the extreme

tenderness has begun to pass away, a narrow tumour, the shape of a finger, may be felt; or, where there has been rupture of the appendix, there may be an ill-defined swelling, apparently filling nearly the whole of the right side of the abdomen; a tumour is absent when there is paresis, bands, volvulus, or concretions; and is usually present when there is an intussusception or fæcal impaction. A localised tenderness in the right iliac region is almost invariably met with in cases of appendicitis; it is entirely absent when there is paresis; it will be found when a piece of bowel has become invaginated, and often when there is a volvulus and concretion, but the position will probably be different; it is absent in bands.

In regard to the general condition of the patient, the temperature almost always rises when the appendix is inflamed, while in the other forms of acute obstruction it is very rare to find the temperature above normal, and it may even be subnormal.

The early symptoms of typhoid fever may be mistaken for appendicitis, or *vice versa,* but it usually does not take long to clear up any doubt as to which of these diseases is present. The most prominent signs which assist in differentiating the two diseases are, the general condition of the patient, the severity of the pain, and the variations of the temperature. In typhoid fever there are more premonitory symptoms of depression; headache and pain in the back are not only present, but are usually well marked, and there is little abdominal pain, although there may be a certain amount in the right iliac region. In both of these conditions it is not advisable to palpate often or forcibly, for it gives little information, and may do the patient harm. As regards the temperature in typhoid fever the afternoon exacerbation and the fall in the early morning are fairly regular, each day showing some increase on that of the day before for at least ten days; while in appendicitis the variations in the temperature do not follow any definite course.

Tubercular disease in the neighbourhood of the cæcum may be mistaken for appendicitis when the onset of the appendicular

disease is not very acute, and when an abscess has slowly formed either in the subperitoneal connective tissue, or in the peritoneum when shut off by adhesions. In both there will be the evening rise in temperature, the thin cachectic appearance, drenching perspirations, intestinal disturbance, sometimes diarrhœa and sometimes constipation; and as the symptoms of the one disease thus resemble the other in a very marked degree, the diagnosis will have to depend to a large extent on the physical examination of the patient.

A perinephritic abscess resembles to a certain extent a case of suppuration in the cellular tissue following posterior rupture of the appendix; but the abdominal symptoms will be absent or slightly marked, and there is little, except the swelling, which would lead one to make this mistake.

A psoas abscess will be differentiated by its being impossible for the patient to bring the heel to the ground, or to straighten the leg, when in bed, without arching the back.

Both in fæcal impaction and malignant disease of the cæcum the condition is a chronic one, and the shape of the tumour does not resemble that of a distended appendix; and unless the irritation causes an acute attack in the appendix itself or in the cæcum—a typhlitis—the absence of the usual symptoms will prevent a mistake.

Rarely salpingitis might be mistaken for appendicitis, in a long-standing case, or in the relapsing form; but this error ought never to occur to any one who is accustomed to treat diseases of women, and who is thoroughly conversant with the diagnosis of diseased conditions within the pelvis. As the pain of an acute attack of pleurisy may be referred to the abdomen on the same side, it is well to examine the back of the chest, to prevent what would appear to be a very foolish mistake.

It has been already said that the majority of cases of inflammation of the appendix result in recovery without operative interference, and without the question of operation having

to be considered. In the doubtful cases, and in those where operation becomes necessary, we have to determine when medicinal treatment is going to fail, and what will be the proper time to operate. The question of operation will depend in great measure on the general condition of the patient; and, as long as this keeps fairly good, there is no necessity to interfere, it being understood that an abscess is not present. Pus must always be evacuated without waiting for the general health to break down, and there ought not to be any exception to this general principle.

When a diagnosis of appendicitis has been made, if the pulse be fairly strong and not over one hundred beats per minute, operation need not be thought of. The condition must be carefully watched; and, should the general symptoms not tend to abate, and the pulse quicken and become less strong, a point will be reached where it will be evident that the disease will not be cured by general treatment. We can hardly emphasise too much the necessity of observing the pulse, not only its rate, but the quality of its beat. The temperature is by comparison of little importance, and so long as it does not rise much over 102°, it may be left very nearly out of account. One cannot say, when the heart is beating so many beats per minute, now is the time to operate. A steady rise or fall from day to day, or sometimes from hour to hour, of a few beats per minute, is a much better guide than the rate observed in one case and that in another; and so long as the patient is fully holding his own there is no necessity to open the abdomen. The cases where operation is called for are those where relapses occur so frequently that the patient is becoming more or less of an invalid, and where the general health is breaking down. Except in the very severe attacks, unless the life of the patient is endangered at the moment, one can hardly advise the operation after the first relapse; but when there have been several, it is very unlikely that the disease will subside and the patient become well without an operation, because changes will have taken place beyond

the appendix, which will not be likely to subside, even if the inflammation in the appendix itself be cured.

In addition to operating on the relapsing cases, operation is required, without a minute's unnecessary delay, in the very acute cases where the appendix has ruptured into the peritoneal cavity before adhesions have been formed; and no other treatment but an operation will relieve those cases where a rupture has occurred, either after adhesions have been formed, or where the opening is in connection with the subperitoneal cellular tissue. Under both of these circumstances nothing can be gained by delay; nature may cure, but the odds are heavily against her.

Treatment.—The treatment is either medical or surgical. The medical cases are those where rupture does not take place; and the surgical, where the appendix has given way, and in addition, all the relapsing cases where the general health is breaking down. The patient must be kept thoroughly warm and quiet in bed; and the acute pain at the commencement is to be relieved by a dose of morphia; a quarter of a grain is to be injected; and this dose is to be repeated in twenty minutes, if the pain does not commence to abate. The abdomen is to be covered either by a light poultice, or by fomentations. We do not consider it advisable to medicate the fomentations with opium, for it is impossible to say how much will be absorbed through the skin, and it is better to use the hypodermic method, and thereby know exactly the quantity that has been given. At the commencement, great relief may be obtained by the application of half-a-dozen leeches to the right iliac region; and occasionally an attack may be cut short by this means if employed sufficiently early. It is too late to use leeches when the inflammatory condition is well established, nor should they be put on in too large numbers, for it is not advisable to draw much blood at what may be the beginning of a serious illness. As soon as the diagnosis is made, and the very severe pain has abated, a dose of castor-oil should be given, unless the bowels have been already freely

opened. The effect of a brisk purgative in the early stage of any acute inflammation is always beneficial, and there does not seem to be any sufficient reason why we should not avail ourselves of this remedy. After the bowels have been thoroughly moved, they can be left alone for several days; salts or mineral waters should not be ordered, as they are apt to cause too much irritation and peristaltic action.

Sweating should be encouraged, and good nursing is most important. The food is to be light, the patient being kept on gruel, milk and water, and clear soups, no solid food being given until the evident symptoms of inflammation have passed away. The return to solid food is to be made very carefully and gradually, beginning with toast and milk, a palatable form of bread and milk, then fish, chicken, etc.

After the acute pain is over, the patient should be kept comfortable and at rest by the administration of small doses of morphia; one-twelfth or one-ninth of a grain is to be injected, perhaps three or four times in the twenty-four hours; but as seldom as possible, consistent with obtaining the object in view. When the attack is passing off, and if there be any trace of discomfort, tenderness, or a feeling of resistance in the right side, an occasional blister may be put on, one inch square, at McBurney's point; and as one heals another may be put on, radiating from this situation; or the whole side may be painted every second night with Churchill's tincture of iodine. The relative proportions of the iodide of potassium, iodine, and alcohol are one, five, and forty.

When the case has been cured, and it is time for the patient to get out of bed, special attention must be given to avoid chills and over exertion for two or three months. A broad flannel bandage or cholera belt must be worn by the patient for at least a year, but preferably for all his life.

Enough has been said to show that, in our opinion, surgical treatment is to be undertaken as soon as the diagnosis of perforation has been made, or where the patient is suffering from

the relapsing type of the disease; and what remains to be discussed is simply, how is the operation to be done? We shall divide the operative methods into two classes: the first, where a positive diagnosis has been made; and the second, where the diagnosis is doubtful. It is not necessary to mention again all the precautions which must be taken to protect the patient and to keep him warm. The most convenient line of incision is one parallel to Poupart's ligament, rather less than one inch above it, commencing a little to the outside of the deep epigastric artery, and continued outwards and upwards for three or four inches. This line of incision is preferable to that along the outer border of the rectus muscle, as the appendix is more easily reached, and there is not so much fear of opening into the abscess close to its inner border. The division of the abdominal wall is not to be made exactly as has been previously described. Instead of cutting directly towards the peritoneum, the incision is made to slant away from the middle line of the body, so that the abscess cavity may be opened, if possible, outside the peritoneum. As the incision is deepened, careful examination must be made with the finger to determine the exact condition; and if it be found that the abscess cannot be opened without dividing the peritoneum, this must be done cautiously. When the tissues are much matted together it will be impossible to distinguish the different structures, and the plan will be to work towards the ileum on the chance of finding the abscess.

If the case is to be a difficult one, the incision may be enlarged, if the operator finds that he can gain more freedom by doing so. If the collection of pus be not come on as soon as the peritoneum is opened, the finger is to be introduced into the wound, and gently insinuated among the adhesions; and if pus be not reached, the colon will have to be followed until the appendix is arrived at. The very greatest care must be exercised in separating adhesions, very little force must be used, especially towards the inner side, for fear of making an

opening into the general peritoneal cavity. The appendix may have to be enucleated out of a bed of adhesions, and if this be difficult it is best done by separating it all round at its connection with the cæcum, ligaturing it at this point, dividing it, and then dissecting it out, and in this way avoiding traction on the colon. When the appendix has been divided, the pouting mucous membrane is to be cut off, and the interior, beyond the ligature, purified with a 1 in 500 solution of corrosive sublimate. It is safer not to stitch over the end, but to leave it open for fear of some small collection between the stitches and the ligature. When pus is present, there is usually not much difficulty in removing the appendix; in some cases it may be found to be gangrenous, and lying loose among the pus; or it may be easily seen still attached to the cæcum, when the pus is emptied out. After the evacuation of the abscess any concretion or fæcal mass must be looked for, and the finger passed into the cavity examines to find if there be any secondary collections or pouches. If none be felt, adhesions must not be broken down in a search for them for fear of causing rupture. One or more large rubber tubes are put in to drain the cavity, and the wound is closed, at least as far as this seems safe. The wound should not be left open, nor should the abscess cavity be filled with gauze, as the tendency to ventral hernia seems to be considerable. A large antiseptic dressing is put on, and is to be changed within the first four hours. The wound does not require to be washed out if the progress be satisfactory, and the size of the drainage tubes is to be reduced at the end of forty-eight hours if the patient be doing well.

When the case is not seen until late, and the abscess is threatening to point, the incision must be made over the swelling, and in as suitable a position as possible for future drainage.

When the patient is not seen until there has been a rupture into the peritoneum, either directly from the appendix, or secondarily from the abscess cavity, the incision should be made

in the middle line; and if the rupture has been from the appendix it can be removed, the abdominal cavity washed out with warm water, and drained with the ordinary glass tube.

When rupture has been secondary, a second incision is to be made in the inguinal region, and the pus removed from both the peritoneal and abscess cavities, and one drainage tube fixed in the median incision, and a second in the inguinal. This plan ensures the complete removal both of pus and irritating fluid, and also permits of free washing out, if the progress of the case should render that necessary.

When the diagnosis is not considered to be certain, a median incision, for the purpose of exploration, is first to be made. If the abdomen be not much distended, the incision need not be longer than will admit two fingers, the right inguinal region is explored, and if a swelling be found there, stitches are to be introduced into the median wound, but not tied; a sponge is inserted so as to temporarily close the wound, and the rest of the operation is conducted as if the exploratory had not been made. Should a rupture take place through the adhesions, the first wound can be utilised for washing out the peritoneal cavity. Should this accident not occur, the abscess cavity is drained through the inguinal incision, and the stitches in the median incision are tied after the sponge has been removed, a tube not being required to drain the general cavity of the peritoneum.

There is nothing special to say about the after treatment, as it does not vary from that of any other abdominal operation, though special care should be taken by strapping the wound to make the scar as narrow as possible; and this strapping of the wound should be kept up for at least three months after the operation, if the skin will bear it.

It has been suggested, before operating on a case of appendicitis, to insert a fine aspirator needle to clear up the diagnosis. It does not seem to be necessary to enter into any details of

this procedure, for it is a practice which does not offer any advantage to the patient, and which is very likely to increase whatever mischief is present at the time it is made. It cannot do good, and it is not to be employed under any circumstances.

CHAPTER IX.

THE LIVER.

Surgical Anatomy.

Although the liver is capable of a certain amount of mobility, it may, for all practical purposes, be considered as one of the abdominal organs whose position is definitely fixed. Roughly speaking, it may be said to be situated in the right side of the body, filling the right hypochondrium, and extending across the epigastrium into the left hypochondrium. From above downwards it reaches from the fourth interspace to the free border of the ribs on the right side. It extends across the subcostal angle, with the lower border in the position of a curved line drawn from the "ninth right to the eighth left costal cartilage, and crosses the middle line about a hand's breadth below the xiphi-sternal articulation" (Quain), a triangular space in the pit of the stomach being thus left unprotected by any bony covering. This unprotected part of the liver lies in direct contact with the abdominal wall. As the liver is not absolutely fixed, a certain amount of movement is possible, and it is found that the exact position is varied by the posture assumed, and also by the action of the lungs and diaphragm.

Artificially also, the liver may be pushed out of its usual position, as for example, by tight lacing, by the pressure of a pleuritic effusion, etc. The upper border may be determined by deep percussion; the lower, either by percussion or by palpation.

The position of the gall-bladder is on the under surface of the right lobe of the liver, with the fundus situated beneath the ninth costal cartilage. The body lies over the hepatic flexure of the colon, the first part of the duodenum, and the neck is sometimes in contact with the pyloric end of the stomach. It cannot be felt in health, but it is said that the notch in the anterior border of the liver, formed by the shallow depression in which it lies, can be made out on careful examination. The gall-bladder normally measures about four inches in length, and one and a half in width. When abnormally distended, its position is in that of a line drawn from the edge of the ninth costal cartilage to the umbilicus.

The gall-bladder ends in the cystic duct, which is fully one inch in length, and is joined by the hepatic duct near the transverse fissure of the liver. The common bile duct—ductus communis choledochus—which is thereby formed is nearly three inches in length. It descends in the gastro-hepatic omentum to the right of the hepatic artery, and anterior to the portal vein. Thereafter it passes posterior to the first part of the duodenum, and continuing downwards it usually coalesces with the pancreatic duct, the two passing by a common opening through the wall of the second part of the duodenum on its inner and posterior aspect.

Practically the whole of the surgery connected with the liver is conducted in or through that part which is uncovered by the ribs and sternum. One would hardly expect the liver to be an organ that would stand surgical interference well; and operations, other than the simple opening of an abscess, have only been performed in the past few years.

Since the early days of ovariotomy it was known that the liver might be injured even extensively without the injury being of necessity fatal. Bleeding was found to stop comparatively easily by pressure, or on the application of a styptic, and injury during an operation did not seem to cause any special shock.

Operations on the Liver.

The conditions for which operations are performed on the liver itself are two, viz. abscess and hydatid disease.

Abscess of the Liver.

Hepatic abscess is rare in people who have lived in a temperate climate, though it may result from a direct injury, or in connection with operations on the rectum, or it may follow diseases in the right iliac fossa, as in typhoid fever, or it may occur in pyæmia. A common cause is the suppuration of a hydatid cyst, but here also we have climate as an important factor. The most usual history, however, is that the patient has lived in a hot climate, and has suffered either from malaria or dysentery.

The pus is usually situated deeply in the substance of the gland. It is not infrequently found that there are, in the early stages at least, several abscesses, and as these increase in size they usually coalesce. Most commonly the abscess is situated towards the posterior surface of the liver and in the right lobe. Abscesses here, as elsewhere, tend to point, and the direction in which the pus is inclined to travel varies; the most frequent mode of exit is through the lung, this being much more usual than into the pleural cavity, and it is a decidedly favourable way; or the abscess may open into the abdominal cavity, the pus passing either into the peritoneum, or into the intestinal canal, the latter being also a favourable direction; the third and least dangerous, though unfortunately the least common mode of exit, is when the pus tends to come to the surface of the body, and to evacuate itself through an opening in the skin. When this is so fortunate as to happen, the skin opening is usually below the ensiform cartilage.

Symptoms.—Locally, tenderness and pain in the region of the liver, or in its neighbourhood, or in the right shoulder;

enlargement of the organ; fluctuation occasionally; pain on turning, the back being the most easy position to lie on.

Generally, fever, rigors, emaciation, disturbance of the stomach and bowels, harsh skin, sweating, sallow complexion, and usually depression of spirits. Rarely, jaundice with anasarca and ascites. If these symptoms were always present, or even present in any marked degree, the diagnosis would be of the simplest; but an abscess of the liver may be present without one well-marked symptom to draw attention to the organ. There may be only general debility, with an occasional feeling of chilliness and some slight uneasiness in the right side.

Treatment.—The treatment of a hepatic abscess must be carried out on the general principle that pus must be removed as soon as possible. Various methods have been employed to do this; the aspirator is one of those which deserves special attention, for it is not only a means of diagnosis, but its use has been followed by complete recovery, though such a happy result can only be expected in exceptional cases. In using the aspirator the only thing to be specially remembered is, that as the liver moves with respiration the cannula must be allowed to move also, or the result is that the soft liver tissue may be torn. In all other respects the same precautions must be taken when the liver is punctured as are employed when the needle is used in any other part of the body; one caution only need be given, not to exhaust the air too forcibly. The essentials, it may be repeated, are cleanliness, a fine needle, emptying of the abscess cavity as far as possible, and leaving the patient in such a position that the puncture opening is at the highest level. Aspiration ought to be looked upon rather as an aid to diagnosis than as a method of treatment, but it can be had recourse to even in cases where another plan of treatment is considered to be better, when for some reason or another the patient is not able to have at the time any more formidable operation. A second plan which has been frequently carried out is that of puncturing with a trocar and cannula, and then leaving the hollow instrument to act as a

means of drainage. After a few days, when it may be reasonably expected that adhesions have formed, a rubber drainage tube replaces the metal one. When this is done it is well to pass the rubber tube through the cannula, or at least to preserve the direction of the canal by passing a probe, over which the cannula is first withdrawn and then the drainage tube is inserted. Neither this method nor that of making an opening by means of caustic potass or other similar substance is used as much as formerly. The special objections to the caustic treatment are that it is both slow and painful, and in addition the opening may not be made over or near the abscess. There is too much working in the dark with both these plans, and there is no sufficient advantage gained by doing so.

Incision, with drainage, is undoubtedly the most suitable, the most convenient, and the most satisfactory method of treatment. In the older books it will be observed that the fear of the peritoneal cavity, a fear well justified in the days when the necessity for surgical cleanliness was not understood, was constantly before the eyes of the early operators. The great desire was to avoid opening the peritoneal cavity, and this was accomplished by causing the part of the liver which was to be opened to adhere to the parietal peritoneum, and thus allowing of a track being formed through which a passage for the exit of the pus could be made without running the risk of opening into the abdominal cavity. Hence the caustic plan already referred to, hence also the plan of waiting as long as possible in the hope of adhesions having formed, and hence also the double operation, the first stage being directed to the formation of adhesions, and the second to the evacuation of the pus.

When adhesions have been formed between the abdominal wall and the liver, the matter may be evacuated by a simple incision. One cannot be absolutely sure that adhesions have formed, and the result might and probably would be very serious if slight or even no adhesions at all were found. The pus, possibly putrid, would escape into the peritoneal cavity.

It will therefore be better to consider direct incision simply as a fortunate circumstance discovered while performing the operation of opening the abdomen and suturing the liver to the wall, which will be shortly described.

The operation in two stages is likely to disappear with the knowledge that it is not the injury, but the infection of the peritoneum which is to be feared. It consists in making an incision over that part of the liver where the abscess is supposed to be situated, and in suturing the liver to the edges of the wound. The softness of the liver substance renders the procedure not an easy one, and if the abscess be near the surface it may be quite impossible to get a sufficiently firm grasp. After a few days the abscess is opened, and a rubber drainage tube is passed into the bottom of the cavity. The great objection to opening the abscess is the delay which the method of necessity entails.

Hepatotomy.

The operation of opening a liver abscess through the abdominal cavity is called hepatotomy; it consists in opening the peritoneum, and in stitching the liver to the abdominal wall after evacuation of the pus. The incision through the skin will be made, if possible, in the longitudinal direction; the length will be somewhere between three and five inches, and will depend on the thickness of the abdominal wall. No effort should be made to work through an incision shorter than is perfectly convenient, and it is thus better to make it too long than too short. The experienced operator will naturally manage with a shorter incision than one who is not accustomed to perform abdominal operations. The exact position of the incision will vary with the supposed position of the abscess. When the liver is found to be adherent beneath the wound, the incision can be extended at once into the liver, so as to open the abscess, or the pus may be evacuated with the aspirator, though the latter procedure presents no special advantage in the present

circumstances. Should there be no adhesions beneath the wound, but a little to one side, it may be possible, by making a second incision through the abdominal wall, to open the abscess without having to stitch the liver; this is, however, not very likely to occur. When there are no adhesions the best point for making the opening into the liver is to be fixed on, and sponges are to be packed around this part to prevent any escape of pus into the peritoneal cavity. The abscess is then to be emptied as completely as possible with a Wells' tapping trocar and cannula attached to the aspirator; this instrument is used to avoid a greater flow of pus than the sponges might be able to soak up. When the pus has been completely drawn off, the trocar opening is freely enlarged, the edges are kept apart by the help of catch forceps, which must not grasp the soft liver tissue too firmly, and the interior of the abscess cavity is carefully sponged out. Any rough handling will quickly set up bleeding. Hæmorrhage from the cut surface of the liver can be arrested either with sponge pressure, assisted, if necessary, by perchloride of iron, or by the introduction of silk or catgut sutures; and it must be remembered that when friable tissue is sutured it is not advisable to use very fine material.

As there may be in any case one or more secondary abscesses, any appearance of such must be carefully looked for, and if any be found they are to be opened through the abscess cavity which has been already emptied. The opening may be made either with the trocar or with a pair of sinus forceps. Should the pus be putrid it is advisable to wash out the abscess cavity with a warm antiseptic lotion; a saturated solution of boracic acid is very suitable for this purpose. After the abscess cavity has been thoroughly cleansed, the sponges are to be removed from the abdomen; and, if the directions have been properly carried out, it will not be necessary to wash out or even to sponge the peritoneal cavity.

The surface of the liver surrounding the opening and the parietal peritoneum round the abdominal wound must now be

brought closely in contact, so as to make a direct track for the escape of the discharge from the abscess cavity without there being any risk of a leak occurring into the peritoneum. The opening in the liver is to be first brought into contact with the wound, that it may be seen to what part it can be fixed without causing traction. If the abdominal wound has been made too large, sutures are introduced in the ordinary way, and left untied until the liver has been secured. This is done by passing a stitch through the wall on one side, taking a firm hold of the peritoneum, and then through the corresponding side of the liver opening. In this way the parietal peritoneum and the peritoneum covering the liver are brought together and the stitches tied. Stitches must be introduced in this way all round, and when a sufficient number are used, about three to the inch, the two peritoneal surfaces are brought quite closely together.

When the cut surfaces of the liver are bleeding freely the stitches may be passed in a somewhat different manner. The needle is introduced as before through the wall and into the abscess cavity, it is then returned in the contrary direction, passing from the abscess cavity half an inch to one side of the point of entrance, through the liver and then through the abdominal wall from within outwards. As soon as all of the stitches have been introduced those which include the liver are tied before the others which close the abdominal wall. One or more large-sized rubber drainage tubes are put in, extending from the bottom of the cavity to the skin edge, and they must not be allowed to project for fear of pressure on the interior of the abscess. A large absorbent dressing is put on, and should be changed for the first time in a few hours, after that twice in the day will probably be sufficient.

The abscess cavity should not be washed out unless the discharge be putrid.

The position of the patient after the operation ought to be that which will allow of as free drainage as possible. As the

discharge lessens, the drainage tube is gradually shortened, but one must not be in too great a hurry to lessen its calibre. In some cases it may be necessary to open a liver abscess through the space between two ribs, or after resection of one or more ribs. Here the operation does not differ in any essential detail, except that it will be necessary to shut off the cavity of the pleura, but if this cannot be managed the pleural cavity must be thoroughly drained.

Hydatid Disease of the Liver.

Hydatid cysts of the liver are situated either on the surface or deeply embedded in the substance of the gland; they may be single or multiple, usually the former, and they occur most frequently before middle life.

Symptoms.—These are at first slight or altogether absent, and in the later stages they depend very much on the position of the cyst. When situated on the upper surface it is natural to expect that the lung will be pushed upwards; when situated so as to cause pressure on the vena cava there will be symptoms due to venous obstruction; or there may be jaundice. In other words, the symptoms are caused by the size and position of the cyst, the actual disease being painless, and not affecting the constitution in any way unless there be suppuration.

On examination a rounded cyst may be felt projecting from the liver, or there may be more or less uniform enlargement of the whole organ, even when the disease is situated somewhat superficially, but more especially when it is placed deeply. The growth is comparatively slow, the disease having been known to exist for many years. It has to be distinguished chiefly from chronic pleurisy, from an ovarian tumour, and from hydronephrosis.

There may be nothing to differentiate a chronic pleurisy with slight effusion from a case of hydatid cyst on the upper surface of the liver except examination of the fluid. The only symptom which might lead to the suspicion of the presence of a growth

connected with the liver would be pain in the region of the right scapula, but even this we may have with pleurisy. The fluid from a hydatid cyst is of a slightly milky colour, its specific gravity varies from 1004 to 1013, it does not contain albumen, and it holds in solution one-half per cent. of common salt, the presence of this being shown by the appearance of a white cloudy precipitate on the addition of a weak solution of nitrate of silver. If the deposit be examined microscopically, hooklets may be found. The fluid of a chronic pleuritic effusion, on the other hand, is of a more or less straw colour, its specific gravity varies from 1005 to 1030, it is markedly albuminous, and it does not contain any common salt.

At first one would think it almost impossible to mistake an ovarian tumour for hydatid disease of the liver, but there is no doubt that this has not infrequently been done. The abdomen may be filled by a large fluctuating tumour, which has given rise neither to pain nor to discomfort, which has not affected the general health in any way, and which may give a dull sound on percussion over the whole front of the abdomen. The history may tell nothing, for a patient has been known to assert that a liver cyst was first noticed in the lower part of the abdomen. The uterus will be freely movable in the case of a liver cyst, but it is not infrequently as freely movable when an ovarian tumour is present. When there is an ovarian tumour large enough to be mistaken for a hydatid cyst of the liver there will be a greater amount of emaciation of the chest and arms than of the rest of the body, while a hydatid cyst will have caused either no emaciation or a general thinning of the whole body. The presence of the hydatid fremitus is of importance, while its absence does not mean anything. Should the cyst be aspirated, the chemical and microscopical examination of the fluid, combined with the direction in which the cyst collapses, will settle the question between these two diseases should the naked eye appearance of the fluid still render it doubtful.

In a case of hydronephrosis there may be a history of a

condition which gives rise to this disease, as, for example, a renal calculus. There may also be a record of the temporary disappearance of the tumour; the colon may be felt on the tumour either as a rounded cord or as a tympanitic track; and the cyst will bulge more into the loin, especially in comparison with the opposite side. The fluid of a hydronephrosis is in appearance not unlike that of a hydatid cyst, it sometimes contains albumen, it is of low specific gravity, and it contains common salt but in smaller quantity than in the hydatid fluid; urea may or may not be present. The microscope will probably settle the diagnosis between the two.

Treatment.—A hydatid cyst may be cured naturally and without any treatment by the absorption of the fluid, which causes the death of the scolices and their subsequent fatty, calcareous, or caseous degeneration and transformation. Rupture may occur, and if the fluid be not quietly absorbed it is dangerous, either primarily, as when it takes place into the vena cava, and then it is of course fatal; or secondarily, as when the disease is scattered broadcast over the whole of the peritoneal cavity. It is not therefore advisable to allow the disease to go on too long, and treatment must be of a surgical nature. One of two plans must be adopted: the first is the complete removal of the fluid with the aspirator, the usual precautions being taken, and the second is by incision followed by drainage. Other methods have been adopted, viz. simple puncture, puncture with the withdrawal of a few ounces of fluid, emptying and the injection of some fluid, such as iodine, and electrolysis. Though cases have recovered after these four plans of treatment, so fortunate a result is far from common; besides, they are accompanied by a decided amount of risk to life, for in all fluid is allowed to remain in the sac, and is likely to escape into the peritoneal cavity through the opening which has been made. The advantage of the complete emptying of the sac over these other methods is that the risk of escape of fluid is prevented, while there is at the same time more

hope of recovery. This plan of complete removal really belongs more to diagnosis than to treatment, the best method being undoubtedly incision and drainage. This operation is performed in exactly the same way as the operation for liver abscess, and here also one must be certain that no secondary cysts are left unopened; and the sac cannot be emptied too carefully, as the result of allowing any escape of hydatid fluid into the peritoneal cavity might be disastrous.

The opening into the sac has been sometimes closed immediately, and stitching to the parietal wall dispensed with; but although such a procedure is neater and more elegant, it seems to be running an increased and unnecessary risk.

Hydatid cysts in the liver not infrequently suppurate, and when they do the symptoms resemble those of liver abscess, except that they are frequently not so marked. The following is an example of a case of hydatid cyst of the liver cured by tapping:—A lady, thirty-six years of age, was seen by Dr. Keith in 1876; she had lived in Australia for six years, and had noticed a swelling in the pit of the stomach for five years. The growth had been quite painless, and the patient sought advice simply on account of the size and disfigurement. The swelling was limited to the upper part of the abdomen, it was almost central, and the dull liver note was continuous with it. The history and situation pointed to hydatid disease of the liver, and the tumour was emptied with the aspirator, a fine needle being used. Six years afterwards the sac had not refilled.

Cancer of the Liver.

This is of importance, surgically, only in relation to diagnosis. When the growth is multiple it is not likely that a mistake will be made, unless it be confounded with syphilitic gummata. When the growth is single, as it usually is when the disease is of a secondary nature, a cancerous mass may be mistaken for dilatation of the gall-bladder, or for a hydatid cyst. The

diagnosis will be assisted by examination of the general condition of the patient, there will be more or less emaciation, with a somewhat quickened pulse, there will be a sallow appearance of the skin, running not infrequently into jaundice, and there may be some ascitic fluid. Before any operation for malignant disease in connection with any part of the abdomen is undertaken, it is advisable to examine the liver carefully. We have heard of a rectum being excised for cancer, when at the *post mortem* examination masses were found in the liver which might easily have been discovered before the operation.

The Gall-Bladder.

Gall-stones are more frequently found between the ages of forty and sixty than at any other period of life, and they seem to be more common in women. They are usually met with in persons of a sedentary habit who live well. They may be found in the gall-bladder, in the cystic, hepatic, or common ducts, in the liver itself, in the intestine, and in almost any other organ, having reached it by ulceration, as for example, they have been found in the lungs and in the urinary bladder.

Nothing is known of the exact reason of their formation, they consist in great part of cholesterine, which is precipitated in certain abnormal conditions of the blood and bile, found most frequently in those affected with a gouty or uric acid diathesis, and they may be of all shapes and sizes. It is usual to find that there are either a few large calculi or a number of small ones, many hundreds being sometimes found.

The presence of gall-stones does not of necessity give rise to symptoms, nor is it necessary to resort to any surgical treatment simply because they are known to be present. Still, the condition is not one which is absolutely free from danger; the presence of these stones may lead to injury of the wall of the bladder; inflammation followed by suppuration may be set up; or a stone may pass from the bladder and give rise to trouble

in the cystic or common ducts, or in its passage through the intestine. Ulceration and destruction of the gall-bladder at one point will allow even a large calculus to pass into other organs. This ulceration usually occurs at the fundus of the bladder, and, if there have been sufficient irritation to cause adhesive inflammation, the calculus may pass through the abdominal wall, or into the stomach or intestine, without doing much harm. If, on the other hand, the gall-bladder open directly into the peritoneal cavity, or if the ulcerative process go on to the destruction of a large blood vessel, a fatal termination is the result; but this will not happen without the occurrence of previous symptoms.

Symptoms.—The most common symptom is the occurrence of biliary colic. The pain comes on suddenly and lasts for a few minutes, seldom for longer than a few hours; it comes in paroxysms, and is situated to the right of the pit of the stomach, radiating to the back and towards the right shoulder. Between the paroxysms there is a feeling of weight and soreness in the pit of the stomach and towards the right side. During a paroxysm the pain is very severe, it is often accompanied by vomiting, and it may even cause rigors or fainting. As soon as the attack is over the soreness is gradually relieved. Sometimes there is jaundice, either of a passing character, if the stone be but temporarily impacted, or permanent, if the hepatic or common duct be occluded. Unless the attack be much prolonged there is little effect produced on the general condition ; the pulse and temperature do not rise, and in this way it may be possible to differentiate the passage of a calculus from any acute inflammatory condition.

During an attack it is often difficult to examine the liver very carefully, but when this can be done the organ is usually found to be enlarged, and there is tenderness over the gall-bladder, which may or may not be distended.

Opinions differ as to whether an attack of biliary colic is more likely to come on after meals or not, but it is undoubted that active exercise not infrequently is the starting point of the

passage of a stone. An attack of biliary colic seems sometimes to start from a confinement. The condition runs in families, especially in those of the gouty type.

Treatment.—The treatment during the passage of a stone consists in the use of hot fomentations, in the administration of morphia with belladonna often in large doses, and sometimes the inhalation of ether or cholorform may be required. After the acute attack of pain is over, it is well to give a dose of mercury, followed next morning by a saline draught.

It is not necessary to advise operation as soon as the pain caused by the passage of a biliary calculus is over, for there may never be a second attack of colic, or, should there be one, it may occur only after a long interval. The treatment to be adopted consists in attending to the general health, and in attempting to eliminate the gouty poison which is so often present. To assist in the easy passage of a stone, and also to prevent their formation, ten grains of the bicarbonate of soda in a bitter infusion taken at bedtime every alternate month is advised. Olive oil in large doses, beginning with one or two teaspoonfuls and increasing the dose rapidly until a pint is taken in the day, is well worthy of a trial, and seems to be of undoubted value in some cases. Some of the oil can be taken in salad.

Manipulation of the bladder, a kind of massage, seems to favour the passage of a stone at times, a simple examination being sometimes sufficient to cause a stone to pass downwards.

Various mineral springs are useful in these cases; at home there are Harrogate and Leamington; abroad, Marienbad, Vichy, Kissingen, etc.

The operative treatment for calculi in the gall-bladder will be considered along with that for distension of the organ.

Distension of the Gall-Bladder.

This is caused by some obstruction due to the wall (mural); by an obstruction, or the presence of foreign bodies, in the

ducts or bladder (intramural); and by pressure from the outside (extramural).

Catarrh may be given as an example of the first.

The presence of a calculus in the cystic or common ducts, or of a number of calculi in the bladder itself, are examples of the second.

Obstruction due to the third cause is seen in the pressure caused by the presence of malignant disease.

Distension is most frequently due to the blocking of a duct by a stone, however formed, and the symptoms will depend upon the exact position of the impaction. This can easily be explained. If the cystic duct be closed, there is no obstruction to the direct passage of bile from the liver into the intestine, and there is consequently no jaundice. The symptoms are limited to the disturbance which results from the distension of the gall-bladder, and to the inflammatory changes which may take place either in its walls or in the fluid which it contains. The walls may become adherent to other organs and may ulcerate, or the fluid may become purulent.

When the obstruction is absolute, and is situated in the common duct, it is evident that no bile can flow into the intestine, and that there must soon be ever increasing jaundice. The liver suffers, it becomes enlarged and tender, and, whether the obstruction be in the cystic or common duct, the gall-bladder is felt as a more or less oval, tender, fluctuating tumour. This swelling when small is situated in a line drawn from the natural position of the fundus of the gall-bladder to the umbilicus, but when large the weight may alter this direction. Parasites may, though rarely, take the place of a stone in causing obstruction.

Pressure from the outside is practically always caused by cancer, which is frequently situated in the head of the pancreas. On this account it is necessary to make a correct diagnosis and thus avoid an unnecessary operation. In the early stages this is by no means easy, especially as calculi are sometimes

associated with cancer; later in the course of the disease, a nodular growth may be felt in the region of the gall-bladder. That viscus becomes more or less fixed and tender, and generally there is rapid emaciation with a quickening pulse.

When the gall-bladder is extended simply by a large collection of calculi, it is found to be hard and irregular, fluctuation is absent, and the swelling is usually movable, and painless on pressure. The size is also constant, or should it vary, the difference will be very slight.

The contained fluid which has remained for a length of time in the gall-bladder may become altered in character; it may become clear, and the bladder then has a white glistening appearance.

This was well seen during the course of an abdominal operation some twelve years ago. The gall-bladder projected as a long sausage-shaped tumour, having a peculiar pearly white appearance. The distension had not given rise to any symptoms, nor were there any when the patient was last seen a number of years after the operation.

In other cases the fluid remains as a thick yellowish-green liquid, or it may become changed into pus. When the fluid suppurates, there are, in addition to a possible history of calculi, very much the same symptoms as have been described in abscess of the liver. When the gall-bladder is distended its walls are usually thinned, though in some cases they become much hypertrophied.

The following account of a case, either of an enormous distension of the gall-bladder, or of a peculiar cyst of the liver, is worth relating in detail:—In the summer of 1882 a young woman of dark complexion, aged twenty, was admitted to the Edinburgh Royal Infirmary. For two and a half years the patient had noticed that her abdomen was getting large, and she stated both before and after the operation that the swelling had commenced at the lower part of the abdomen. The girl herself had not thought it necessary to see a doctor, and she did

so only at the suggestion of her mistress. She had always been perfectly healthy, had never been jaundiced, and had never required to take a dose of medicine in her life. Examination showed that the abdomen was distended by a large unilocular thin-walled cyst. Percussion gave a dull note over the whole front of the abdomen, and vaginal examination simply gave the information that the tumour did not enter the pelvis, but could be felt at its upper part. The only thing against the diagnosis of ovarian tumour was that there had not been any emaciation of the chest. On opening the abdomen in the middle line, a thin membrane, resembling a very much stretched-out omentum, was found to be adherent over the whole front of the tumour. This was slightly separated, and the cyst was tapped by an ordinary large trocar. A bright yellowish-green fluid resembling bile came away. As the cyst was emptied and drawn forward it was seen to be wanting in pelvic attachments, and was then traced up to the liver. A large part of the sac was removed, and the remainder was stitched into the upper part of the abdominal wound and drained, after it had been thoroughly washed out with carbolic lotion. Twenty-four pints of bile were removed from the cyst, the exact origin of which could not be made out. On the eleventh day the discharge was purulent, and by the forty-fifth the sinus had entirely closed. The patient has remained perfectly well.

Diagnosis.—An enlarged gall-bladder may be mistaken for a tumour of the right kidney, or for a floating kidney, and especially when there is a combination of these two conditions. Other growths with which it may be confounded are, a solid outgrowth from the liver, a cyst of the pancreas, or when very large it may be mistaken for any cystic growth in the abdomen.

It is differentiated from a growth of the kidney by its position being closer to the abdominal wall, it does not extend so far into the loins, the intestine is not found lying in front, what mobility there is will be in a different direction, and the examination of the urine may give some definite information.

The symptoms will also assist in making a diagnosis. In comparison with a movable or floating kidney, we have to depend on the shape and different range of mobility, including the possibility of pushing the kidney back into its place in the loin.

A solid localised growth of the liver due to the presence of cancer or syphilis will be diagnosed by the shape and exact position, by the absence of fluctuation, and by the general symptoms to be found when such diseases are present.

For the differential diagnosis of mesenteric and pancreatic cysts we have to rely on the history, on the exact position of the swelling, and on the presence or absence of symptoms pointing to the enlargement of the gall-bladder.

Treatment.—It has been previously said that a biliary calculus does not of necessity require removal.

Should there be repeated attacks of biliary colic, the question of removal of the stones arises, and the decision will have to lie very much with the patient, for he or she must decide whether they will undergo the operation or go on hoping that each attack of pain will be the last, for these attacks do sometimes cease. A simple distension of the gall-bladder where there are no symptoms does not require operation, it may be safely left alone as long as it does not give trouble.

When there is suppuration, or where there is jaundice, the case is different; with the former there are symptoms necessitating operative interference; with the latter it is not safe to leave things alone, as there is no doubt that great risk is incurred when the patient has become saturated with the bile poison.

Though Marion Sims was not the first to operate on the gall-bladder, the surgery of that viscus may be said to date from his first operation in 1878. The usual operation—cholecystotomy—consists in opening the bladder and stitching it to the abdominal wall. A few surgeons prefer to remove the bladder entirely; this operation is called cholecystectomy. Names have been given to two operations which may be described as further

stages of the operation of cholecystotomy. They are cholelithotomy and cholelithotrity, and signify respectively the removal and the crushing of calculi in the gall-bladder or in the ducts.

Cholecystotomy and Cholecystectomy.

These operations are performed for the removal of one or more stones in the bladder or in the duct, for distension of the bladder from other causes, and also for injuries of the bladder.

Cholecystotomy.

Unless the abdomen be much distended by the tumour, a vertical incision three or four inches in length is to be made over the most prominent part of the swelling.

Should the growth be very large, the incision must be made nearer the liver, to be able to reach the ducts if necessary. After the peritoneum has been opened in the usual way, sponges are to be packed round the gall-bladder, unless adhesion prevents this being done. When operating for stones, where there is no distension, much greater difficulty than might be expected may be met with in finding the gall-bladder. If there be any fluid, the next step is to withdraw it with the aspirator, a needle of fair size being used. The needle must be inserted low down, for the fixed point of the gall-bladder being above, the opening might be drawn so far upwards as to be above the upper angle of the wound when the cyst wall contracts. The cyst wall is sometimes very thin and friable, and care must be taken not to hold the aspirator needle too stiffly, as the wall might tear against it and allow the fluid to escape. For the same reason the catch forceps used to grasp the sac after it has been emptied must not have too firm a catch; those used for preventing the slipping of the ovarian pedicle after cauterisation will be suitable for the purpose. The sac is then drawn forward to the abdominal

wound by the forceps, the aspirator needle is withdrawn, and the opening is enlarged with scissors to allow of the easy entrance of one finger. The interior of the sac is then thoroughly explored. If stones be felt, the opening is still further enlarged, and they are removed either with forceps or with a scoop or spoon, and the sac is then thoroughly dried out. One must not be satisfied with the removal of the stones from the bladder, the ducts must be examined, and this is to be done very carefully, especially when there is jaundice. Should a stone be found in the cystic or common duct, the ingenuity and perseverance of the operator may be taxed to the utmost. The manipulation required to remove a calculus from one of the ducts must be conducted most gently and carefully, for the walls are thin, and may be easily injured or even torn. Sometimes the stone can be grasped with forceps and withdrawn, or it may be reduced in size by careful chipping with a needle, and the manipulation will be greatly assisted by fixing the stone with two fingers of one hand outside the duct, but inside the peritoneal cavity. It may be possible to dilate the cystic duct and thus to remove a stone from the common duct. It has also been said that a *stone* has been crushed *in situ* by forceps or the fingers. Efforts have frequently been made to push a stone onwards into the intestine, but it is not likely that this could be done as easily as it could be drawn backwards, for the stone has already passed through the cystic end of the duct while it has been arrested by the intestinal end which has not been dilated.

The sponges are now to be removed, and as the general peritoneal cavity had been shut off by them, sponging is not required. The gall-bladder is to be fixed to the wound without tension if possible, and if the sac be very large, part of it may be removed. If the parietal wound be large, stitches are passed through the walls in the usual way to reduce its length, and they are not to be tied until the stitches securing the gall-bladder have been introduced. The method of suturing the gall-bladder is as follows : The first stitch is passed through the

wound on one side, then through the lower part of the sac as it lies in relation to the wound, and finally through the parietal wall on the other side. The second one passes through the wall on one side, enters the sac one-third of an inch above the first, again as it lies in relation to the wound, and is returned through the sac and parietal wall on the same side, having included one-third of an inch of sac wall. The two ends of this stitch come out on the same side of the wound one-third of an inch distant from each other. Other stitches are introduced in the same way until the upper part of the wound is reached, when one similar to the first is put in. The other side of the sac is fixed to the wound in the same way, ordinary silk sutures being used. This is the best plan, but some prefer to use one or two continuous sutures, and find this satisfactory. It is not advisable to make the opening too small, and to be certain of efficient drainage an indiarubber tube is put in. The dressing is changed as often as necessary, any absorbent material, such as wood-wool wadding, being used. The drainage tube can soon be dispensed with, as the stitching prevents too rapid closure of the wound. If there be no obstruction to the flow of bile into the intestine the abdominal fistula will probably close in six or seven weeks; but if there be a block in the common duct the bile will naturally go on flowing through the wound, and attempts to close it will certainly fail, indeed nothing else could be expected.

An alternative plan to the formation of a fistula is to sew up the wound in the gall-bladder, if the stones have been removed, and if there have been no suppuration. It is undoubtedly much more satisfactory to be able to close the abdominal wall completely, but it is usually recognised that, as in the case of irremovable cysts in the abdomen, it is safer to stitch a sac to the parietal wall; and also in the case of the gall-bladder experience has shown that there is decidedly more risk incurred when a fistula is not made. The special risk of stitching the opening is that it is difficult, perhaps impossible, to say that no calculus is left in the common duct. Should there be obstruction damming back

the flow of bile it will pass into and distend the wounded bladder, and thus at the very best no relief will be obtained. The edges must be turned in, so as to bring peritoneal surfaces together, and a fine continuous stitch is best for this purpose. Sometimes the gall-bladder is more or less atrophied, and cannot be brought in contact with the wall. In a condition such as this the operation is likely to be performed for obstructive jaundice, and the stones must be removed. The treatment of the bladder itself will lie between its removal or the stitching together of the edges of the opening. In cases such as these removal of the bladder seems to be the better operation. There is no particular advantage in leaving an atrophied bladder, and its total removal does no harm, and is at the same time less dangerous.

The operation of removal of the gall-bladder does not present any special difficulty if it be not adherent. In rare cases, where the gall-bladder has become atrophied, and where there is much adhesion, it may be a matter of very considerable difficulty to discover its exact position.

Cholecystectomy.

The operation is performed by separating the bladder from the liver, beginning at the fundus. This is best done by means of a sponge, the fundus of the gall-bladder is laid hold of, and the connections are simply sponged off. When the bladder has been entirely separated, and the cystic duct has been reached, this last connection is ligatured with silk, and before it is divided a pair of catch forceps is used to close the opening on the bladder side. This is less trouble, and takes less time than the common practice of dividing between two ligatures. The open end of the duct is to be thoroughly cleansed with a little wadding dipped in a 1-500 solution of corrosive sublimate. During the separation hæmorrhage may be at first brisk; it may be checked with sponge pressure, or a few ligatures of fine cat-

gut may be required to arrest the larger vessels which may have been injured.

When a fistula has been formed and bile continues to flow from it, and when the stools show that no bile is passing into the intestine, it is evident that there is an obstruction in the common duct. To get rid of the annoyance of the constant outward flow of bile, and at the same time to obtain the benefit of this secretion, it has been suggested that an opening should be made between the fistula and the intestine, the connection with the bowel being made as high up as possible. The plan which Greig Smith suggests is the following:—"(1) Abdominal section below and up to the site of the fistula. (2) Suture of a convenient portion of the intestine to the under aspect of the gall-bladder, as near as possible to the fundus and over an area as large as convenient. These sutures to pass through the serous and muscular coats only, and to extend from the margin of the fistula at least an inch downwards. (3) At the end of a week or so, perforation of the apposed and adherent surfaces by a cutting operation. This might readily be done through the abdominal fistula, and would not require anæsthesia. A small solid bougie of rubber or decalcified bone is placed in the opening, and left for a few days longer until it has become a fistula. (4) Blocking of the parietal fistula as soon as the fistula between gall-bladder and bowel has been established. If simple mechanical pressure does not succeed, then a plastic operation might be performed. Such an operation, though somewhat tedious, is not dangerous; the whole of the proceedings are carried out near the surface, almost under the eye; and it follows up and takes advantage of perfectly natural processes of adhesive inflammation and fistula-formation."

In an operation of this rare nature one would have to be guided very much by the exact condition of the parts. It seems that it might be more easy to bring the intestine and the fistula together by small perforated bone plates. The external opening would have to be enlarged upwards so as to get the plate into

the bladder; immediately below the external opening the abdominal wall would have to be divided and the intestine caught up; a bone plate would then be introduced into it, the two joined together, and the opening connecting the bowel and the liver would be at once established. No difficulty would be experienced in passing a sound through the interstitial opening and the original fistula would soon close, or the edges could be pared and brought together.

Injuries of the Gall-Bladder.

Injury of the gall-bladder is a rare accident; when it does occur it is usually caused by a stab or blow inflicted when the gall-bladder is distended. Rupture may also occur from ulceration. Should bile appear through the wound, or through an opening caused by suppuration, the diagnosis can be made with certainty. Should no bile be seen, the diagnosis is simply a matter of conjecture, assisted by the position of the injury and by the general condition of the patient. The simple extravasation of bile into the peritoneal cavity does not appear to be of necessity a fatal accident; but should a suppurating gall-bladder rupture, the result will be very different.

CHAPTER X.

THE KIDNEY.

Surgical Anatomy.

The kidneys are situated one on either side of the vertebral column, and measure about four inches in length, two inches and a half in breadth, and one inch and a quarter in thickness. The left is somewhat larger than the right, and also somewhat narrower and longer. The weight of each gland varies from four to four and a half ounces.

One cannot make a dogmatic statement regarding their exact relations, as they are not absolutely fixed, and as they vary both in size and in position, and are usually lower in women than in men. They lie deeply in the epigastric and hypochondriac regions, to which the left kidney is usually confined, but the right extends nearly an inch lower than the left, and so occupies a part of the umbilical and right lumbar regions. The right kidney lies alongside the twelfth dorsal and first three lumbar vertebræ, being pushed down by the liver; the left reaches as high as the upper border of the twelfth dorsal, and barely so low as the third lumbar vertebra. From the front, about one half of the right kidney is covered by the chest wall, and proportionally more of the left. On deep inspiration, both, but especially the right, are pushed down to an appreciable extent, and in this way it is often possible to feel with great distinctness fully one half of each gland. The outer borders of the kidneys correspond with the outer border

of the erector spinæ muscles, and are situated about four inches from the vertebral spines.

Both kidneys lie behind the peritoneum, the anterior surface, which also looks outwards, being covered more or less by that membrane. They are kept in position by their vessels and by a bed of adipose tissue which surrounds them. The posterior surfaces look inwards and backwards, and rest upon the

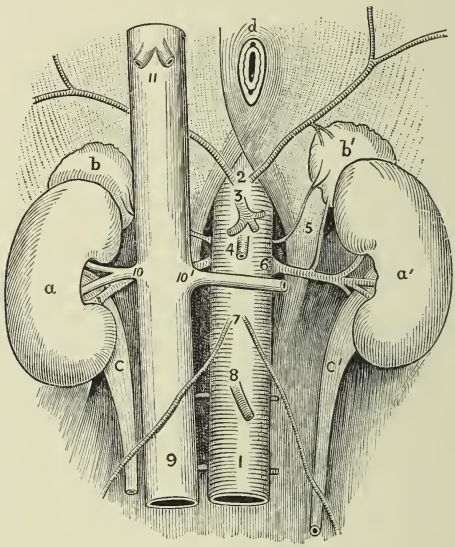

Fig. 17.—Diagram to show the Normal Blood Supply of the Kidneys. (Hepburn.)

1, Abdominal aorta; 2, phrenic arteries; 3, cœliac axis; 4, superior mesenteric artery; 5, middle suprarenal artery (left); 6, renal artery (left); 7, ovarian (or spermatic) arteries; 8, inferior mesenteric artery; 9, inferior vena cava; 10, 10′, renal veins (the left is cut); 11, hepatic veins; *a*, *a′*, kidneys; *b*, *b′*, suprarenal capsules; *c*, *c′*, ureters; *d*, œsophageal opening in diaphragm.

diaphragm, lumbar fasciæ, and the psoas muscles. In front of the right are the liver, the second part of the duodenum, and the hepatic flexure of the colon; the position of the latter being of especial importance, as it is pushed forwards by enlargements of the kidney. It is thus an aid in diagnosis, and its position has also to be borne in mind while operating. In front of the left are the stomach, spleen, pancreas, and the descending colon.

The blood supply comes direct from the abdominal aorta. Before entering the kidney the renal artery usually divides into several branches, and there is not infrequently a second or inferior renal artery coming off from the aorta farther down. Renal arteries may also arise from the common iliac, the inferior mesenteric, or the middle sacral arteries. More rarely a renal

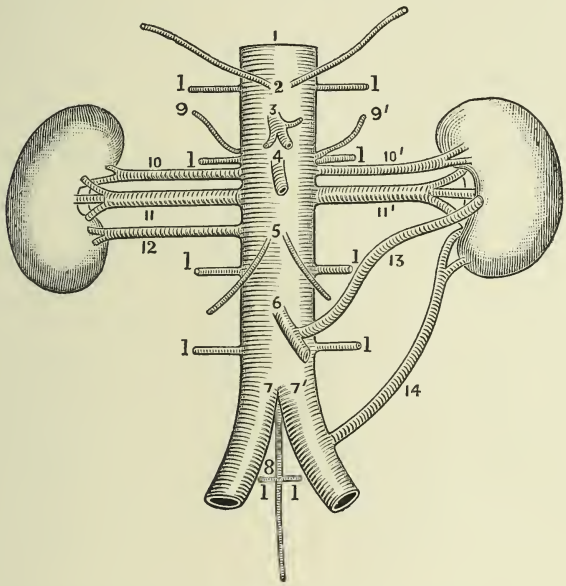

Fig. 18.—Schematic Diagram to show the nature of certain of the more frequent forms of Accessory Renal Arteries. (Hepburn.)

1, Abdominal aorta; 2, phrenic arteries; 3, cœliac axis; 4, superior mesenteric artery; 5, ovarian (spermatic) arteries; 6, inferior mesenteric artery; 7, 7′, common iliac arteries; 8, middle sacral artery; 9, 9′, middle suprarenal arteries; 10, 10′, superior accessory renal arteries; 11, 11′, renal arteries; 12, inferior accessory renal arteries; 13, accessory renal from 6; 14, accessory renal from 7′; *l*, lumbar arteries.

artery has been seen arising from the internal iliac, and one case is recorded in which both renal arteries sprang from a common trunk on the front of the aorta. The right renal artery is longer than the left, and passes behind the vena cava inferior. The left vein is the longer, and passes in front of the aorta and posterior to the third part of the duodenum.

Each kidney is entirely invested by a strong fibro-elastic

capsule called the tunica albuginea, which is turned inwards at the hilum, and forms sheaths for the blood vessels entering the organ.

The ureters are about fifteen inches in length. They are situated behind and quite free from the renal blood vessels, and pass obliquely downwards and inwards from the kidneys to the bladder, lying posterior to the peritoneum throughout their whole course. They have the appearance of whitish collapsed tubes the size of a goose quill. Having crossed the common or external iliac vessels—the right one behind the termination of the ileum, the left one behind the sigmoid flexure of the colon—they enter the true pelvis and pass downwards, forwards, and inwards to reach the outer wall of the bladder, being then situated two inches apart. They run for three quarters of an inch obliquely through the walls of the bladder, and by the time they have entered that viscus the slit-like openings are within an inch and a half of each other, and a similar distance behind the urethral orifice in the prostate. In the female they pass on either side of the neck of the uterus, and about three quarters of an inch from it before entering the bladder wall.

The position of the kidney may vary in three different ways: one variation is acquired, one is congenital, and the third is sometimes acquired, though usually congenital. These three alterations in position are known as the movable kidney, the floating kidney, and the displaced kidney.

Movable Kidney.

By a movable kidney is meant one where the organ has an abnormal range of movement behind the peritoneum. This condition is due to a more or less complete disappearance of the fat surrounding the kidney, which is known as the tunica adiposa, and also to some lengthening of the blood vessels. The condition is seen in any wasting disease, and it is also common in women who have borne children, partaking both of

the softening and relaxation of the pelvic and subperitoneal tissue generally.

The amount of movement varies, and may even be so great as to allow of the kidney being felt on pelvic examination. There is sometimes a history in these cases of some shake or jar, which appears to have first started the kidney from its bed, the symptoms being not uncommonly described as having commenced after a rough drive or a slip while coming downstairs. A movable kidney is met with much more frequently in women than in men, it is seen especially in women who have borne children, and the right is more often movable than the left. The cause of this is probably due to its relation to the liver.

Floating Kidney.

A floating kidney is one where free movement of the organ is possible on account of its anatomical relations. Instead of lying behind the peritoneum it is surrounded by that structure, and is attached by a mesentery or meso-nephron. This condition must be a congenital one, and a greater and different range of movement is permitted than in the case of a movable kidney.

Displaced Kidney.

A kidney may be found to be permanently fixed in an abnormal situation, due either to some congenital or acquired displacement. In its altered position the kidney will be found lying either in front of the sacro-iliac synchondrosis, in the iliac fossa, in front of the sacral promontory, or more rarely entering the true pelvis. Except from a diagnostic point of view these displacements are not of much importance surgically, but if the condition were not known, or were forgotten, an unnecessary exploratory incision might be made to clear up a diagnosis.

The left kidney is more frequently displaced than the right,

and, as the disease is found more often under such circumstances than when the kidney is in its normal position, it is at least probable that displacement is conducive to some of the altered conditions here met with.

Symptoms of Movable and Floating Kidney.—The symptoms of movable and floating kidney resemble each other, except that in the former case they can often be traced to some distinct cause, while in the latter there is no history to account for the displacement. In a slight case, there is usually a feeling of discomfort, with perhaps some sensation of weight and dragging in one side, this feeling being entirely or almost entirely relieved on lying down during the night, and beginning to return by the time the patient has got dressed in the morning. Exercise or any jar or shake, as in driving over a rough road, or in falling or slipping downstairs, increases the discomfort. In an extreme case this feeling of discomfort increases into actual pain, and may be accompanied by marked gastric disturbance. Flatulence with colic and even sickness is not uncommon, and there may also be sudden attacks of severe pain resembling those of renal colic, which may be accompanied by symptoms of uræmic poisoning due apparently to the obstruction of the flow of the urine. This is caused either by a bend or kink in the ureter, or it may be due to twisting of the blood vessels.

The patient is usually aware of the presence of a movable swelling in one side of the abdomen. The size and shape of this will resemble that of the kidney, and it can be easily pushed back into the loin. The swelling is sometimes but by no means always tender to the touch, and is seldom if ever actually painful unless roughly handled. On comparing the two sides of the body when the swelling is in its abnormal position, the one side will feel more empty, and will become filled when the kidney is replaced.

A lady thirty-six years of age, whose general health had not been good for some time, and who had lost a considerable

amount of flesh, complained of pain and discomfort with a feeling of weight and dragging, amounting almost to a bearing down. On making a vaginal examination the edge of a rounded tumour was felt high up on the right side. On placing the hand on the abdomen, it was evident that the swelling did not have any pelvic attachment, and it could be pushed into the natural position of the kidney. There was no doubt about the diagnosis, and it was almost equally certain that the case was one of movable and not of floating kidney. Women with these movable organs are usually neurotic, but this is probably due to the condition of health, which has led to the absorption of the tunica adiposa.

Percussion does not give much information; anteriorly it does not give any; and although in the back the note will be found more resonant on the side from which the kidney has become moved, the diagnosis can be more satisfactorily made in other ways. During menstruation the kidney becomes decidedly more sensitive, and it is said that an increase in size can be made out at these times.

The range of mobility varies in the movable and in the floating kidney; in the former the organ moves almost entirely up and down; while in the latter the mesentery allows not only of this downward displacement, but the kidney has some lateral mobility, and may even cross the middle line. A movable or a floating kidney may be mistaken for a tense cyst of the mesentery, for a tumour of the omentum, for a distended gall-bladder, or for a small ovarian tumour with a long pedicle. A mass of fæces may also be mistaken for it, and a case of hydro-salpinx has been diagnosed as a movable kidney.

Treatment of Movable and Floating Kidney.—The treatment of a movable kidney is to be directed to the original cause of the condition, viz. that which is accountable for the loss of padding. The general health must be attended to, the patient must rest, and avoid shaking and active exercise, and in some cases relief may be obtained by an abdominal bandage; a curved

pad placed inside of an ordinary belt will often keep the kidney in its place. An arrangement of this nature need not be worn except when the patient is up and going about. The treatment of a floating kidney must be entirely mechanical.

When the symptoms caused by a movable or floating kidney are of such gravity that an operation is rendered advisable, what is done is to endeavour to fix the kidney in its proper position in the loin by an operation known by the name of nephrorraphy.

Nephrorraphy.

The steps of the operation are as follows. The incision is made in the space between the ribs and the crest of the ilium. In some there is plenty of room in this situation for carrying out all the manipulation which is required. In others the costal margin and the ileum may be so close together, that it is advisable, when the patient is lying on the side, to place a small firm pillow so as to raise the opposite side, and thus enlarge the space through which the incision is to be made by causing a lateral curvature of the spinal column. Before commencing the incision, the last rib is to be found, and it must be remembered that the twelfth rib may vary in length on the two sides. It is of importance to be perfectly certain that the twelfth rib has been found, because if a mistake were made and the eleventh taken as the guide, the pleura, which is attached to this rib might easily be opened, should it be found necessary to enlarge the incision.

Commencing a little below the twelfth rib, and immediately outside the mass of the erector spinæ muscle, the incision is carried for at least three inches downwards and forwards, the exact line depending on the amount of space between the ribs and the ileum of the patient. The incision is deepened until the tunica adiposa is divided and the capsule of the kidney has been reached, scissors being used for this purpose, and the

straight line being kept by the help of forceps, as described in making the ordinary incision through the linea alba. As soon as the capsule is reached or before the incision is completed in its whole depth, if the bleeding be profuse, all the blood vessels are secured by catch forceps, and they are twisted or tied at once to avoid inconvenience from the presence of the forceps. When the incision has been completed, the assistant, with his hand on the abdomen, pushes the kidney, which might and probably would be out of reach on account of the position of the patient, backwards, upwards, and against the wound, and he must continue this abdominal pressure until the stitches have been introduced. For suturing the kidney a short curved needle with needle-holder is required. For this purpose there is no better instrument than that of Marion Sims, though Hagedorn's is also convenient. If a long-handled curved needle be preferred, those used by Mr. Annandale for cleft palate are the best.

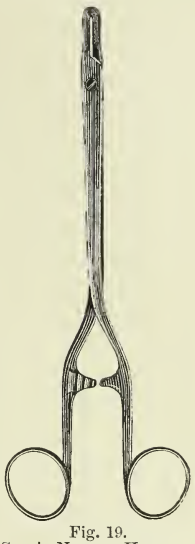

Fig. 19.
SIMS'S NEEDLE-HOLDER.
(One-third size.)

The stitch is passed through the tissue of the wall near the kidney on one side, through the fibrous capsule of the organ, and through a corresponding extent of the wall on the other side. When the abdominal wound has been closed this suture is completely buried.

When a firm hold can be got on the capsule, and silk stitches are used, it is better not to enclose the parenchyma of the kidney in the suture, as this might be followed by atrophy of the enclosed part of the organ; if, however, the suture is of some absorbable material it is of no moment whether the suture passes through the kidney substance in addition to the capsule or not. It is best to use a number of sutures, and after they have been introduced, the fibrous capsule is to be thoroughly scarified, as well as the tissues which will be in direct contact

with the kidney. Bleeding must be carefully stopped before the wound is closed, and should there be any difficulty in bringing the whole of such a deep wound together, a buried layer of catgut sutures may be introduced to close the deeper part of the wound. It is better to do without drainage if possible, but a tube should always be introduced if there has been any troublesome oozing. Various kinds of suture have been used to fix the kidney, the best is probably well prepared catgut; but silk, silkworm gut, and kangaroo tendon have all been tried by different operators. Catgut suturing of the capsule of the kidney, combined with thorough scarification, seems to give the best results, but other methods have been employed, and with success. Some incise the capsule of the kidney and stitch it to the surrounding parts; others advise the introduction of large drainage tubes to make irritation and consequent adhesions; and others again are content to stitch the tunica adiposa to the deeper parts of the abdominal wound without interfering with the kidney itself. This latter plan is not to be recommended, and must never be done unless the tunica be first opened to make sure that the kidney is not movable within it, as is sometimes the case. To give the operation every chance of success it is necessary to keep the patient in bed for at least three weeks; and even when this is done and every possible care is taken, the result may not be entirely satisfactory. Should the operation fail, the want of success will be due rather to some fault or omission on the part of the surgeon than to anything the patient can have done, provided that he has not got out of bed before permission has been given. The operation does not present any special difficulty, and, with the exception of the needle-holder, no special instruments are required for its performance.

It is not often that the symptoms caused by the presence of a movable kidney are of sufficient severity to warrant us in advising any operative measures being taken, but in some cases the life of the patient may be rendered absolutely miserable;

and, when this is so, it is universally considered that the operation of stitching the kidney into its proper place in the loin is a proper course to recommend. The risk of such an operation, when ordinary precautions are taken, is not greater than when any incised wound is made of a similar length, and the patient's future health is not interfered with in any way. This is not the case when a floating or movable kidney has been removed, as has been sometimes done. It is impossible to understand how such an operation can be justified, unless the symptoms are very distressing, and one or two attempts to fix the kidney by suturing have failed. When it is remembered that the removal of one kidney means that the other will have to do double work, and that the chances of life are very much reduced, one can hardly imagine that the removal of a healthy kidney could ever be a justifiable operation.

When, in addition to the mobility, the kidney is itself the seat of a surgical lesion it may be right to remove the organ, but the operation is then performed not for the mechanical difficulty, but for the disease. Should a movable kidney, on the other hand, be found in a patient who is suffering from any non-surgical disease of these organs, any operation is out of the question.

Diagnosis of Displaced Kidney.—A displaced kidney may, like a movable or floating one, be mistaken for a mesenteric or omental tumour; for a collection of fæces in, or malignant disease of, the bowel; for an ovarian tumour; or for a dilated Fallopian tube.

The diagnosis of this condition is made by finding that the kidney is absent from its usual position, from the shape and consistency of the swelling, from the fact that it does not increase in size, and from the general history.

Malformations of the kidney are frequently met with along with displacement. One kidney may be entirely absent, or the two may be joined together either intimately or by a fibrous band, thus forming what is well known as the horse-shoe kidney. Surgically the absence of one kidney is of

importance, as this will prevent all operative interference; and, where the two are joined together, no operation will be proper unless the organs are found to be connected simply by a band. In such a condition operation may be performed on one organ, or one may be entirely removed after the division of the fibrous connection, and the patient recover.

Renal Calculi.

A common cause of kidney disease is the presence of calculi either in the pelvis, in the calices, or in the substance of the kidney itself. These stones occur most frequently in the young, and in those over the age of forty. In the former the calculus which is commonly found is one consisting of urate of ammonia, and its formation seems to be principally due to errors of diet. It is met with most frequently amongst the poorer classes, and is more common in some localities than in others. When a renal calculus is found in a patient over the age of forty, it will probably be formed of oxalate of lime or of uric acid. Here again errors of diet have much to do with their formation; people as they get up in years are apt to eat more, to take richer food, and also less exercise, than they were formerly accustomed to do. Calculi are frequently formed of different materials arranged in concentric layers, and the nuclei may be of various kinds; as for example, a clot, a piece of fibrin, etc. While calculi of urate of ammonia, uric acid, and oxalate of lime are much the most common, a rarer stone composed of cystine is occasionally met with. About this substance little is known, except that the condition predisposing to it seems to be usually a congenital one.

Soft phosphatic stones are not very often met with in the kidney, their common situation is in the bladder, and they usually collect round a nucleus which may consist of any material. Various rare calculi have also been met with in the kidney.

Renal calculi are found either in the pelvis of the kidney, in one calyx, or in a combination of these two situations, the branches of the stone passing from the pelvis into the calices, thus resembling a mass of branching coral; or the stone may be found in the substance of the kidney; or it may be arrested in the ureter while passing from the kidney to the bladder.

Symptoms.—The symptoms vary with the position which the stone has taken up in the kidney, and with its size and exact nature; as, for example, a calculus situated deeply in a calyx may remain entirely quiescent, while a movable one in the pelvis may cause suppression of urine and other symptoms.

A stone firmly fixed in any part of the kidney will cause little or no pain, and will not give rise to any symptoms; a movable one, on the other hand, especially if small or rough, will give rise to well marked and distressing symptoms. The rough oxalate of lime or mulberry calculus, as one would expect, is the stone which gives rise to most pain, that symptom being least marked when one composed of uric acid is present.

The usual symptoms of the presence of a stone in the kidney are pain of a dull aching character, which may be entirely absent when the patient is at rest in bed, but begins to return when he gets up, and is as bad as usual by the time he has dressed. This pain is increased on movement, especially on active exercise; it is worse when driving, even in a well-built carriage, and in a marked degree if the springs are bad and the roads rough. The pain is situated in the loins and back, it often passes downwards along the course of the ureter, and may even cause symptoms resembling those of the presence of a stone in the bladder; it also passes into the testicle or ovary, and there may be retraction of the testicle when the suffering is very acute. The whole of the side, over the ileum down to the thigh and leg, and extending even as far as the foot, may be painful. The loin and side of the affected kidney are tender on pressure. Attacks of hæmorrhage from the kidney are a very common symptom, especially after rough movement, and the blood which

is passed at these times is always found to be thoroughly mixed with the urine.

Crystals or small fragments of stone may be found on microscopic examination of the sediment of the urine, and this examination may have to be repeated a number of times, for it will not do to be satisfied with one or two inspections, unless a positive result be obtained. The microscopic examination must be carried out with the most scrupulous care. When the stone has been setting up irritation in the kidney for a considerable time, it is usual to find that more or less pus is present in the urine, and this in its turn sets up an irritable condition of the bladder, leading to some degree of cystitis, with frequent micturition.

These are the direct symptoms usually met with in a case of renal calculus, but at times a patient may have been perfectly well, and there may have been absolutely nothing to make him think that there is anything the matter, either in the kidney or anywhere else, until the presence of a swelling is discovered in the loin. The tumour is the distended kidney, and is due to the damming back of the urine by the blocking up of the pelvis and calices with a stone which is usually branching and coral-like. The indirect symptoms are entirely reflex, having no direct connection with the urinary system; they consist of headache, and more especially of disorders of the digestive apparatus, flatulence, nausea with retching and even vomiting. A great difficulty in the diagnosis is, that while a stone may be present without giving rise to symptoms, it is by no means uncommon to have all the symptoms of a stone, and these even well marked, when a calculus is not to be found in the kidney or ureter.

Although a calculus may be formed in the kidney it need not of necessity remain in that situation, and it happens not infrequently that a small calculus passes through the urinary passages and is discharged from the body without any very serious symptoms. Natural means of cure may sometimes be obtained by a visit to a suitable watering-place, and it is said also by the persistent and entire use of distilled water.

The mechanism by which a calculus is driven down the ureter and into the bladder is probably twofold. In the first place, it is forced onwards by the contraction of the muscular fibres of the ureter, which is set up by the irritation due to the presence of the stone, and to the distension which it causes. In addition to the muscular contraction, the weight and pressure of the urine will assist in the downward passage, and it is probable that the urine may help to lubricate and protect the lining surface of the ureter. The pressure caused by the urine will likely be greatest when the muscular fibres of the ureter are relaxed, either by simple exhaustion, or where the same result has been brought about by the use of drugs. The distension of the ureter and the spasmodic contraction of its muscular fibres is the cause of very severe, often agonising pain, and it is known as renal colic.

Any solid or semi-solid substance may give rise to an attack of renal colic; but it is likely to be most painful when a stone, such as a rough mulberry calculus, is being driven through the ureter. A plug of mucus, a clot, or a small hydatid are the common causes of renal colic in addition to the attacks caused by a stone.

Renal Colic.

During an attack of renal colic, the pain is sometimes so severe that the patient may be unable to localise its exact position, but it will usually be described as commencing deeply in the loin and passing downwards and inwards in the direction of the bladder.

Colic due to the irritation caused by the distension of a narrow canal is also seen in cases of hepatic colic, and often at the commencement of an acute attack of appendicitis. Renal colic is differentiated from an attack due to appendicitis, or to the passage of a biliary calculus, by the position of the pain, and the direction in which it passes. It is situated deeply in

the loin and is directed towards the bladder when the colic is renal; it commences at McBurney's point and radiates downwards and inwards in cases of appendicitis; and when it is due to the passage of a biliary calculus it starts from the position of the gall-bladder and passes backwards and towards the right scapula. In addition there is likely to be some history or some symptom pointing to the presence of one of these diseases.

A calculus may pass through the whole length of the ureter within a few hours, or the suffering may be prolonged for several days. When a rough stone is passing, the pain may be so great that it may cause convulsions, and patients have been known to commit suicide.

The amount of general disturbance will depend to a certain extent on the temperament of the patient. In some there may be a severe rigor, followed by complete collapse. During the attack the testicle on the same side becomes retracted, the bladder becomes irritable, the urine, tinged with blood, is usually passed frequently, but in small quantities, and though the other kidney is sometimes stimulated to secrete freely, at other times its action may be entirely arrested.

It is evident that when a stone becomes arrested during its passage down the ureter, no urine can pass from that kidney to the bladder, but a certain amount will collect between the kidney and the point of impaction. This may be followed by symptoms of suppression, and it is not necessary that both ureters be blocked to cause this condition.

When symptoms of suppression of urine come on as an attack of renal colic is passing off, and more especially if there be a history of calculi in the kidney, and no reason to suspect the presence of any other disease, such as paroxysmal hæmaturia or Bright's disease, it will be found that delay means disaster, and immediate surgical interference is called for as soon as medical treatment fails to bring urine into the bladder.

Diagnosis.—The positive diagnosis of one or more calculi, either in the pelvis, in the ureter, or in the kidney itself, is at

times extremely difficult. Even in a well marked and apparently typical case of renal calculus no stone may be found, and there is no symptom, nor combination of symptoms, which makes it possible to say with absolute certainty that a stone is present, short of feeling the calculus itself. It has been said that in thin subjects stones have been detected on abdominal palpation. When a calculus is present in a kidney, it is usual to find that the organ is enlarged, but too much stress must not be laid on this sign, because one kidney may be found to be increased in size, due to a compensatory hypertrophy of the healthy organ, when the other kidney has been more or less destroyed. This sign taken alone might lead to an erroneous conclusion that a stone was present, when the enlarged kidney was really healthy, and some other disease had caused the destruction of its fellow. The sensation of the patient may also prove deceptive, as it is not altogether uncommon for the pain and tenderness to be located in the healthy organ. When making a diagnosis of renal calculus, mistakes may occur by confounding it with bladder neoplasms causing hæmorrhage, and with malignant, strumous, and tubercular disease of the kidney. In bladder growths, the great amount of blood lost, its clotted condition, and the fact that it is not intimately mixed with the urine, will draw attention to the bladder, and an examination of its interior with the cystoscope will, when care is used, discover even a small tumour. Even in the female, where digital examination is very easy, it is better to use the cystoscope than to run the risk of over-stretching the urethra and destroying control over the bladder.

In malignant disease of the kidney hæmorrhage is usually more continuous, and it is only in the early stages that a mistake is likely to occur. Careful microscopic examination will show crystals, or embryonic cells of malignant disease.

It is in the strumous and tubercular kidneys, especially when the disease is commencing, that a mistake is likely to be made. At first there is little except the history and microscopic

examination of the urine to guide one ; the pain will be, as a rule, more severe and sudden if a stone be present and the hæmorrhage is not likely to be so steady, and it comes on after exertion.

When we come to the positive diagnosis of renal calculus, and it has been already pointed out that a certain diagnosis cannot be made until a stone is actually felt, the first procedure we have to consider is that of needling, *i.e.* of inserting a needle into the kidney from the loin for the purpose of detecting the presence or absence of a stone. This is not done so often now as it was a few years ago, for it has been found to be a very uncertain guide, nor is the method entirely devoid of danger. To strike a small or even a large stone at a depth of several inches is by no means easy, and the needle may be inserted many times before the stone is found, or it may not detect its presence. The danger consists in the possibility of injuring a large blood vessel; or, after having unintentionally transfixed the kidney, the colon or intestine may be injured. Besides, an unfortunate result may follow. Numerous needle punctures in the loose cellular tissue of the loin may be the starting point of an attack of inflammation going on to the formation of a perinephritic abscess.

Treatment.— The treatment of renal colic is entirely palliative. The first indication is to relieve pain. Morphia must be given hypodermically, and it is useless to begin with less than a quarter of a grain. In twenty minutes this dose may be repeated if the pain has not begun to show signs of alleviation. Should it get at all less severe, a second dose need not be given so soon, as morphia does not always overcome a very severe pain immediately. The quantity and the number of doses must be regulated entirely by the effect produced. Along with the morphia the one-hundredth of a grain of sulphate of atropia may be given with the view of relieving the spasm of the ureter. The patient is to be kept warm in bed, and he will naturally take up the position which

gives him most ease. That will be on the side with the legs drawn up and the shoulders well forward. Fomentations or light poultices are to be kept on over the abdomen and the loin, and a hot bottle is to be applied to the feet. The skin must be encouraged to perspire, and at times a hot air bath given while the patient is in bed will prove of service. The pain may sometimes be so severe that chloroform must be administered until the patient can be got under the influence of the morphia.

Treatment of Renal Calculus.—When a stone is actually in the substance or pelvis of the kidney little or but temporary relief can be given, except by surgical measures. Rest, avoidance of rough movements, and fomentations are the only means which will give relief, short of the administration of narcotics. A stone may give rise to little more than discomfort, and under such circumstances the simple opinion that a stone is present in the kidney is not sufficient to justify an operation. Should the symptoms be of sufficient gravity to prevent the patient working or enjoying the ordinary pleasures of life, or if there be any evidence of coming disease or destruction of the kidney itself, removal of the calculus by a cutting operation is called for. This operation is called nephro-lithotomy, and it may be performed in two different ways: the one is by a single loin incision, the other by a combination of this with an abdominal incision through the peritoneum.

Nephro-Lithotomy.

The operation for the removal of a stone through the single loin incision is the same as that for nephrorraphy, until the kidney is reached. When the wall is vascular it is best to tie the bleeding vessels as soon as the incision down to the kidney has been completed. The length of the wound will vary from three to five inches, and its exact direction, as in nephrorraphy, will depend on the configuration of the patient. The kidney may be pushed down to the wound by the assistant from the

front, or better, by the one hand of the operator, while with the fingers of the other hand introduced into the wound the whole of the kidney is examined with the most minute care. Should several localised hardnesses be detected, and there is a doubt as to whether they are stones or not, a fine needle may be introduced to settle the question; if, however, there be only one such hardness, the incision into the kidney is to be made at once. The incision may be made either through the pelvis or through the substance of the kidney, and in both of these situations there is one drawback; when it is made through the pelvis there is a slight risk that the opening will not heal, and that a urinary fistula will remain permanently; when the kidney itself is incised there may be troublesome hæmorrhage. The balance between these two plans is about even, and it is therefore best to have no fixed rule, but to be guided entirely by the position of the stone, and thus be free to make the opening into the kidney in whatever seems to be the most convenient situation. If it should happen that no hardness can be detected, there will always be the fear that a mistake has been made, and that it is the other kidney which contains the stone. In such circumstances it is difficult to know what is best to do, for one would be naturally as loath to injure what may turn out to be a perfectly healthy organ, as to make an incision on chance in the other loin. If this operation has been preferred, and no stone has been felt, the better plan will be to incise the kidney, the simple incision and depletion often doing good. When a stone has been detected, the incision which must be made for its removal ought to be large enough to admit the finger. As there is certain to be excessive hæmorrhage from a wound in the kidney, the finger is to be at once passed into the opening to act as a plug, and the exact size and shape of the stone will then be determined. A fine scoop passed alongside the finger will assist in the removal of the stone, or various varieties of crocodile forceps will be found at times of service. Although there may be great difficulty in removing a stone tightly

embedded in the substance of the kidney, every effort should be made to remove it entire, and thus avoid the possibility of leaving behind any fragments which might form the nucleus of a new stone. Bleeding is sometimes very brisk from the renal tissue, but fortunately it can be easily controlled either after pressure has been kept up for some little time with the finger, or if this be not sufficient a stitch of catgut may be inserted through the lips of the wound in the kidney to draw them together. A large-sized rubber drainage tube is put into the wound, extending down to, but not into the kidney, and it must be cut off flush with the skin to avoid pressure on the organ. Silk stitches are introduced through the parietal wall as usual; a large antiseptic and absorbent dressing is put on, and this must be changed frequently. Little time must be spent over this changing of the dressing; the old one must be taken off and the new one put on immediately, so as to expose the back to cold as little as possible, and there must be no roller bandage, the dressing being kept in position by a broad flannel bandage. At first all the urine from the injured kidney comes away through the wound; soon it begins to pass down the ureter, and after a few days the opening into the kidney closes. As soon as the urine ceases to pass through the wound, the drainage tube may be shortened, and it can be withdrawn entirely after two or three days.

The after treatment of this and other operations on the kidney does not vary from that followed after any other abdominal operation, except that morphia should be avoided as much as possible, and when it is required it must be administered in specially small doses. Little or no stimulant should be allowed. It is frequently recommended that neither morphia nor any stimulant is to be given after renal operations, but it is wrong to lay down a hard and fast rule of this kind; the general condition of the patient must always be the guide. It may be that a greater risk is sometimes run by withholding these remedies than by giving them.

The alternative operation which may be performed for the removal of a renal calculus consists in cutting down on the kidney from the front, and extracting the stone through a second incision in the loin. The incision for this operation, and for all others on the kidney where the peritoneal cavity is opened, is to be made through the linea semilunaris on the side of the affected kidney. This line is immediately outside the rectus muscle, and will be found from three and a half to four and a half inches from the linea alba when the abdomen is not distended. The incision through the linea semilunaris must be long enough to admit the hand, and from it the bleeding is rather more free than when the middle line is incised. As soon as the abdomen is opened, it is advisable to pass the hand across the peritoneal cavity to examine the other kidney in case there has been transference of the pain from one side to the other. It is well to do this at once, and thus be sure that the kidney does not present at least any gross lesion, for it is apt to be forgotten later. When no evidence of disease is found in the opposite kidney, the one cut down on is to be examined by the hand inside the abdominal cavity, assisted by the other hand helping to fix the kidney from the loin. It is not sufficient to be satisfied with the discovery of one stone, but the whole of the kidney must be carefully gone over. There must be no exception to this rule. As soon as the presence of a calculus, or even of a hardness at one spot, has been felt, the patient is turned on to the side, the abdominal wound being meanwhile protected by a sponge, and a short incision is made down to the kidney from the loin. The left hand is passed again into the peritoneal cavity, and, holding the kidney, it acts as a guide in cutting down on the stone, and assists in its extraction. When both kidneys have been examined without finding any trace of disease, the ureters must be traced through their whole course from the kidneys to the bladder. Should a stone be found in either ureter the treatment to be adopted will depend on its exact position. If

it be at the upper part of the ureter it may be reached by the ordinary lumbar incision; if lower down the incision must be made as low as possible, opposite the spot where the stone is situated, if that can be managed, and the calculus must be extracted without opening the peritoneum. When it is situated close to the bladder, and is of such a size that it seems to be impossible that it can pass onwards, the best plan probably, when the patient is a man, will be to open the bladder above the pubes, and dilate the orifice of the ureter from the bladder, assisted by the one hand in the abdominal cavity. This would be a most difficult operation, and we are not aware that it has ever been done, but it would be the best treatment under the circumstances. If the patient be a woman the stone may be removed by cutting down on it through the vagina, but this is open to the objection that a urinary fistula would probably remain. If the calculus cannot be reached from the back, and is not close to the bladder, it must be left alone, or the kidney must be removed.

Unless the stone be small and situated deeply in the substance of the kidney, it is improbable that it would not be found by this bimanual method. Still it may be passed over, and symptoms which justify an operation will also justify an incision into the kidney, a procedure which does not seem to be attended by any special risk, and which may do good by depleting the organ. It is also possible that some granulation tissue, whether tubercular or not, may be removed without being noticed. When a stone is not found either in the kidney or in the ureter, the kidney, which is supposed to be the seat of the disease, must be opened and thoroughly explored. There is no condition which would justify this being done through the peritoneal cavity, but it must always be managed through the loin incision. The pelvis is opened sufficiently to admit the finger, and between this finger and those of the other hand inside the abdomen, the whole surface of the kidney is to be thoroughly gone over, and if nothing abnormal be felt a fine

sound is to be passed into each calyx. After this thorough examination, and whether a calculus be discovered or not, the abdominal wound is closed, and the loin one drained as in lumbar nephrotomy.

To any one with even a slight experience of abdominal surgery, nephrotomy by the double incision presents great advantages. Mr. Thornton has done much to show the advisability of this method, and as time goes on surgeons are gradually becoming converted to his views on the subject. The special advantage is its certainty; by the help of the hand in the abdomen the condition of the whole of one kidney, and of one ureter, and of the greater part of the other ureter, can be determined, in addition to what information is obtainable by the lumbar incision alone. The certainty of finding the stone is also greater, and when this is difficult the kidney is less likely to be unnecessarily injured.

The advantage of the lumbar nephrotomy is that an incision is not made into the peritoneal cavity, but this advantage is so infinitesimal, when no septic material is introduced, that it is really not worth considering when so much is to be gained by making the incision into the abdominal cavity.

The extraction of a stone from its bed in the kidney, or in the upper part of the ureter, is sometimes a matter of great difficulty. It must be done with care, especially when it is situated near the peritoneal surface, and is to be managed by the finger, assisted by a small scoop or a pair of narrow forceps. Lister's sinus forceps, made longer than usual, will be found to be a most convenient instrument for loosening a calculus from its position, and ordinary dressing forceps with long shanks for withdrawing it. It is hardly possible to insist too much on the necessity of removing a stone without breaking it while it is inside the kidney.

The treatment of a large branching stone, which has been the cause of hydronephrosis or pyonephrosis, will be considered in connection with the operation of removal of the kidney.

Enlargements of the Kidney.

We now come to the consideration of enlargements or tumours of the kidney. These may be divided for the practical purposes of diagnosis into cystic and solid growths.

As an example of the first variety, we have a simple cyst in the substance of the kidney; a distension of the pelvis of the kidney and calices, to a greater or less extent by fluid—a hydronephrosis; a similar distension, where the contents are purulent—a pyonephrosis; and lastly, a cystic condition of the kidney from the presence of a hydatid tumour.

Solid tumours are either sarcomata or carcinomata, or they may be merely part of a general disease, such as lymphadenoma or syphilis.

Enlargements due to scrofula and tuberculosis hold a somewhat middle position between cystic and solid growths. In the early stages the enlargement is principally solid, in the later stages the growth breaks down and becomes more or less fluid.

In addition to the growths already mentioned several rare tumours of the kidney may be met with. These consist of simple adenoid growths, cavernous and fibrous tumours, and they are, with the exception of the last, of small size, and have seldom been known to give rise to symptoms. An operation is occasionally necessary for simple adenoid growths, and several large fibromata have been removed.

The diagnosis of a cystic tumour is not generally difficult, and it is only in the exceptional cases, or where the tumour is large, that the special characteristics are absent and mistakes are apt to occur. Attention will be first drawn to the history relating to the position in which the growth was first noticed, and to the rate of growth. These tumours usually grow slowly, and the symptoms are seldom distressing unless there be suppuration or the growth be very large. The swelling passes deeply into one or other loin, and is fixed in that position.

One special diagnostic point is the position of the colon; owing to its anatomical relation to the kidney it is pushed forward by an enlargement of the organ, and is always to be felt running across the front of the growth from above downwards, unless the tumour be of very great size. Its position is determined either by percussion, when a line of clear note will be discovered if the colon be distended, or it will be felt as a softish rounded cord fully larger than a flattened-out finger. When the tumour is of very large size, or if the colon has become fixed by adhesions, this diagnostic sign may be absent, because if the tumour has grown more to the outside it may overlap the colon. There is a dull note on percussion over the loin on the side from which the growth has sprung, on the other side the note is usually tympanitic. On examination from the vagina or rectum a tumour cannot be felt unless it be of great size, and in the female the uterus will be found to be in a normal condition in regard to position and mobility. The position of the uterus must not be relied on as being absolutely diagnostic, for it is not infrequently seen that an ovarian tumour does not affect the position and mobility of the uterus in the slightest degree, while a cystic enlargement of the kidney may develop in such a way as to enter the pelvis and displace the uterus to one side.

Solid tumours of the kidneys do not vary from cystic growths in their general characteristics except in the solidity of the mass. They seldom attain to such a large size, and as the position in the loin is therefore more distinct, the differential diagnosis between such a tumour of the kidney and other abdominal enlargements is not very difficult.

Simple Cysts of the Kidney.

Simple cysts of the kidney are by no means common, and when small they are not of any importance; but attention may be drawn to their presence either on account of their size, or

from the growth giving rise to disturbance in the kidney itself, by blocking the ureter, or by destruction of the kidney tissue from pressure.

They grow from some part of the substance of the kidney, and are probably caused by obstruction and consequent dilatation of the tubules. The increase in size of these cysts is slow, and they tend to go on enlarging indefinitely. In this way they differ from cases of distension of the kidney caused by some obstruction in the ureter, although cases are on record of a cyst of this nature becoming emptied by a communication being formed either with the ureter through a calyx, or with the pelvis of the kidney. Should this happen, examination of the urine will show the presence of albumen, and may thus enable one to differentiate a cyst of this nature from hydatid disease or from hydronephrosis. Fluctuation is easily made out, and should the fluid be drawn off with the aspirator it will be found to be of a light colour, to contain albumen, sometimes blood, and, especially when the growth has been very slow, a large quantity of cholesterin. The fluid is not urine, and does not contain urea.

Conglomerate cysts of one or both kidneys have been met with, but it is extremely rare to find that only one kidney is affected. The symptoms are those of an enlarging semi-solid tumour, and it is unlikely that a diagnosis will be made. The disease is of importance surgically by reason of the frequency with which it is found to be bilateral.

Treatment.—As long as the growth is small, and not giving rise to symptoms, such cysts are best left alone. When large, aspiration is the most simple treatment. Should the fluid reaccumulate quickly after several aspirations, a cure cannot be expected by going on drawing off the fluid indefinitely, and removal of the kidney will have to be considered if the gravity of the symptoms calls for such an operation, and if there is nothing in the general health of the patient which would render this operation more than usually dangerous. The

patient ought certainly to be allowed to choose between repeated aspirations and nephrectomy, for the removal of the kidney is a dangerous operation, and entails a considerable amount of risk. If comfort and good health can be obtained by removing the fluid once every year or two, most patients will prefer not to run the immediate danger from the operation, *plus* the remote risks entailed by the removal of an otherwise healthy organ.

Aspiration is to be conducted on proper principles; the needle must be fine, it must be inserted into the cyst at its highest level, and intestine must be avoided.

Removal of fluid through the loin in this and in all other kidney enlargements must never be done, for the opening is of necessity at the lowest level, and thus favours an escape of fluid into the perinephric cellular tissue.

Hydronephrosis.

Hydronephrosis is a distension of the kidney by fluid, accompanied by a thinning and destruction of its substance. Though this condition may be congenital, a peculiarity of it is that there may be no symptoms in early life. The congenital causes are various, they are due either to some want of development, or to some malformation in or outside the kidney or ureter. Both kidneys may be affected at the same time. The ureter may be represented by a fibrous cord, or it may pass from the kidney at too acute an angle, it may be twisted, or it may be occluded by the pressure of a supernumerary artery.

The acquired causes are also numerous, and consist in a more or less complete block at some point of the urinary tract. The most common reasons of this are enlargement of the pelvic organs, the presence of new growths in the bladder or in the neighbourhood of the ureter, and aggravated cases of prolapse of the uterus. A calculus impacted in the ureter,

or at its junction with the pelvis of the kidney, will also cause this distension. More rarely the ureter may be occluded by a stricture, and a bend on the ureter, due either to floating or displaced kidney, may also cause a block.

Symptoms.—The chief symptom caused by a hydronephrotic condition of the kidney is the presence of a fluctuating tumour, arising apparently from one flank. In some cases there may be a history of a disease which may induce this condition, as, for example, cancer in the pelvis, the presence of a calculus, etc. The increase in size is slow, and there is at times in some, but by no means in all cases, a sudden flow of clear water from the bladder, accompanied by the disappearance of the tumour. On this symptom alone too much stress must not be laid, as the same thing results when an ordinary parovarian cyst ruptures into the cavity of the peritoneum, the disappearance of the cyst being accompanied by the flow of a large quantity of clear urine, due to its rapid absorption.

Examination of the urine passed at the time when the tumour has disappeared will show absence of albumen, and this with the presence or absence of some history will help to differentiate a hydronephrosis from a simple cyst of the kidney. If the fluid be removed by aspiration it will be found to be almost colourless, often without any, or only with a faintly urinous odour, of low specific gravity, and it does not contain albumen. When the kidney tissue is entirely destroyed by the distension, there will be an absence of urea; but when the destruction is not so far advanced the fluid will more nearly resemble ordinary urine. The general health is not usually affected when the tumour is small, but when both kidneys have become hydronephrotic, and especially in the advanced stages, general symptoms will be much more marked; the skin will be dry, there will be some abdominal disturbance, with at first slight and then more marked attacks of uræmic poisoning.

Treatment.—The treatment consists either in aspiration, incision and drainage, or in the removal of the kidney. This

operation of removal is called nephrectomy, a comparatively simple one in cases of hydronephrosis, but an extremely grave operation when a large solid growth has to be taken away.

When the diagnosis is clear, and where there is no disease of the other kidney, it is better to remove the cyst without resorting to aspiration, for this palliative treatment is at best but temporary, and the sac invariably refills. Drainage of the sac is not to be recommended unless complete removal be found impossible. When both kidneys are distended the case is entirely different, because, as there is certain to be a considerable amount of destruction of the structure of the kidney, it would be most unwise to lessen that amount by removing any excreting tissue, and besides, the risk of operating on one kidney when the other is not sound is very great. The only plan, in such circumstances, is to relieve the discomfort and misery caused by the distension, by the withdrawal of the fluid when required from one or both of the tumours.

Nephrectomy for Cystic Enlargements.

The preparations which must be made for the removal of a distended kidney, and the instruments which are required, do not differ from those of an ordinary operation for the removal of any cystic tumour from the abdomen. The same precautions to keep the patient warm, and the same scrupulous care in cleaning the skin, must be taken. The only difference will be that the rubber sheet must be fixed so that the linea semilunaris is in the centre of the aperture.

The patient is placed on the back, and the incision is made through the linea semilunaris on the affected side, which will be found farther from the middle line than when performing the operation of nephrotomy.

The length of the incision will depend chiefly on the thickness of the abdominal wall, and should be at least three inches; it can be subsequently enlarged if there be much

difficulty either with the enucleation or with the securing of the vessels.

As soon as the peritoneum has been opened, the hand must be passed in so as to localise the position of the colon should there be any doubt as to its exact position. Immediately in contact with the parietal peritoneum the posterior peritoneum will be seen pushed up by the distension of the kidney, and before the aspirating trocar is introduced, after sponges have been packed in, this posterior layer must be divided outside the colon, as the vessels supplying the gut are situated in the inner layer.

In emptying any cyst where an escape of fluid might cause trouble it is advisable to use the aspirator with Wells' tapping trocar.

When the fluid has been entirely emptied, the trocar is withdrawn and the opening closed with forceps, and after this has been done it may be well to examine the other kidney. The sac has now to be enucleated out of the cellular tissue to which it is attached, and this is easily done, unless there has been at any time an attack of inflammation in this cellular tissue. The secret of success in performing this enucleation is to keep close to the cyst and not to get lost in the cellular tissue, and to carry on the enucleation in the direction of the vessels. A watch must be kept for the ureter, and when it is discovered it is to be divided between forceps, care being taken not to allow any fluid to escape ; the divided ends should be at once disinfected with a strong solution of corrosive sublimate.

As the enucleation comes near to the end, care must be taken to draw as little as possible on the sac for fear of injuring in any way the renal vessels, which form a sort of pedicle. This pedicle is to be transfixed as near to the sac as possible, either with a round-pointed blunt needle, an aneurism needle, or with Lister's sinus forceps, being careful that the instrument does not injure the renal artery or vein. Each half of this pedicle is tied, and the double ends are tied again, and while this is being done

no traction whatever must be made on the sac. Before the pedicle is divided a pair of forceps should be fixed on to its edge on the aortic side of the ligature, so as to command the stump should there be hæmorrhage. The sac must be cut away, leaving a sufficient amount of tissue to prevent the ligature slipping, and if there be no bleeding the forceps can be at once removed.

Should there be any difficulty in enucleating the sac, assistance may be given by passing the fingers or hand into the interior to act as a guide to the exact position.

In a case of nephrectomy for hydronephrosis there is usually little trouble from bleeding, as the sac does not require much nourishment. If necessary, bleeding vessels must be tied with catgut, and as soon as this is done the cavity outside the peritoneum is sponged dry. A drainage tube is seldom necessary; should, however, one be required a counter opening is to be made through the loin, and the wound in the posterior layer of the peritoneum can be loosely closed by a catgut suture, the edges being turned in so that the two serous surfaces will adhere together. The end of the ureter is to be again disinfected, and after it has been closed by a ligature it is brought out at the lower angle of the abdominal wound, where it is kept in position by forceps or a pin.

There is nothing to say in particular about the introduction of the stitches, of which fully as many as usual are required.

Although this is the usual condition which is met with at the operation, there are some cases where it is utterly impossible to complete the enucleation on account of the extent and enormous vascularity of the surrounding tissues.

There is nothing special in the after treatment, except that one has to be careful in the administration of stimulants and of morphia, and this is common to the after treatment of all operations on the kidney. It may be necessary to give one or both of these, but their administration should be avoided whenever it is possible; and when the general condition of the patient

calls for either, the dose should be carefully regulated, and must always be small.

The remaining kidney may be swollen and painful for some days after the operation, and may at first secrete little urine. When this is the case the congested state of the kidney should be relieved by dry cupping over the loin.

The following is a very typical account of a case of hydronephrosis. An unmarried lady, aged twenty-six, had about the age of twenty first noticed the presence of a swelling in the right side. There was no history of any kind of kidney trouble, nor had the tumour ever decreased in size, and the diagnosis of hydronephrosis was made simply on the slow growth and the position of the swelling in the loin. The cyst was tapped from the front, and four pints of clear watery fluid were removed. The cyst filled slowly, and was tapped five times at intervals of about two years. As the general health began to fail the removal of the cyst was suggested, and as the patient was then anxious to have it done the operation was performed in June 1884. The enucleation of the sac was accomplished without any difficulty, the ureter was pervious but not dilated, and strangely enough did not appear to be occluded at any part of its course. It was fixed into the wound. The entire kidney structure had been destroyed, a simple non-vascular cyst alone representing it. After the operation the left kidney swelled up to almost twice its usual size, it had been evidently hypertrophied, and this was accompanied by the secretion of a small quantity of urine, and considerable general disturbance. The lady kept fairly well for fully nine years. While on a visit to London her legs began to swell, the urine was found to contain a small amount of albumen, and the quantity passed was said to be very great. The patient died of uræmia a few weeks later. This case contrasts well with another where the diagnosis of ovarian cyst had been made, and where it was found impossible to remove the whole of the sac.

A young lady, twenty-four years of age, was seen with a

large flaccid cyst entirely filling the abdomen. A short time before this examination the cyst, which had been noticed but one year previously, had been tapped and twenty pints of fluid removed. The fluid was reported to have been viscid and of a yellow colour. A diagnosis of ovarian cyst had been made. There was nothing in the history nor in the examination of the half-filled cyst to make one come to any other conclusion, especially as on pelvic examination the tumour was easily felt displacing the uterus slightly to the left.

At the operation the sac was found to have no pelvic attachment, but the cyst passed deeply into the loin, and the enucleation extended from the pelvic brim to the diaphragm. Eventually it was found that the cyst could not be entirely removed. As much was cut away as possible, and what remained was stitched to the wound, which of course had been made in the middle line. During the afternoon and evening there were two most alarming attacks of hæmorrhage from the cellular tissue, and some enormous clots had to be removed from high up under the diaphragm. For years there was a constant discharge of clear fluid, averaging about one ounce in the twenty-four hours. Some five years after the operation the fluid became altered into pus, quickly diminished in amount, and the sinus became completely closed.

In another case, which had to be treated in the same way, suppuration did not occur for fully six years.

Pyonephrosis.

Pyonephrosis differs from hydronephrosis in this, that the fluid contained in the kidney is not a simple collection of urinous fluid, but consists of pus. The causes which give rise to this condition may be divided into those which are local and those which are more remote. The local causes are irritation of a calculus, tubercular disease, direct injury, or a chill when the kidney is in a hydronephrotic condition.

The more remote causes are septic infection directly from the bladder, or indirectly from the lymphatics when the disease is outside the bladder.

Symptoms.—The symptoms resemble those of a hydronephrosis, but they are more acute. The general health is more markedly affected, though in a chronic case it is remarkable that a large tumour may not give rise to any symptoms beyond the presence of the swelling or a slight feeling of malaise.

The appearance of the patient, the feeling of chilliness, and perhaps some rise in the temperature at night, will point to the presence of pus, and will be diagnostic, especially when there has been sudden decrease in the size of the tumour, accompanied by the presence of pus in the urine. An example of a case where a pyonephrosis did not give rise to symptoms was seen in the summer of 1889. The patient was fifty-four years of age, and had noticed the presence of a swelling in the right side for about two years. There had never been any symptoms referable to disease of the kidney, and in addition to the swelling the only thing complained of was a feeling of general debility, with steady deterioration in the general health. She was not particularly chilly, and there was no rise in temperature. The diagnosis was made of a tumour of the kidney, the exact nature of which was not determined, and removal was advised and agreed to. At the operation the tumour was found to consist of the kidney irregularly dilated with pus. The upper part of the ureter, the pelvis, and some of the remaining calices were entirely filled by a coral-like stone, weighing over three ounces.

Treatment.—The treatment of this condition will vary with the amount of the disease. In an advanced case where the tumour is large, and where it is practically certain that the structure of the kidney has been destroyed, the proper plan is undoubtedly to perform nephrectomy.

When the disease has only partially destroyed the kidney, two methods of treatment have to be considered: the one plan

is to remove the entire organ, the other is to treat the case as an ordinary abscess by free incision and drainage.

What has to be taken into consideration before fixing on either of these lines of treatment is the amount of kidney structure remaining, the time the abscess of the kidney will be likely to take to heal, the general state of the health of the patient, and the condition of the other kidney. The amount of healthy tissue will be judged by the history of the case, the length of time since any symptoms were noticed, and especially by the size of the swelling.

In regard to the length of time that the discharge will be likely to continue after incision and drainage, we must be guided by the constitution of the patient and by his surroundings.

The patient may not be seen until the strength is so far spent that the immediate risk of nephrectomy will be considered greater than that of an incision, followed, if necessary, at some later period by the removal of the organ.

The condition of the other kidney is of great importance in this connection. If it be not healthy the less formidable operation must be tried first, as, so long as the suppurating kidney has any excreting tissue, it takes off at least some of the work to be done by the other damaged organ.

When incision and drainage are determined on, the opening is to be made into the abscess through the ordinary lumbar incision. The kidney is to be freely incised, its interior examined with the most minute care so that a stone may not be left behind, and care must be taken that pockets are not left, which might prevent free drainage. The cavity is to be thoroughly washed out with a warm saturated solution of boracic acid, and one or more short wide drainage tubes, either of glass or of rubber, are left in the wound. A large absorbent and antiseptic dressing is put on, and will have to be changed within the first few hours.

If the abscess has been thoroughly opened, and the drainage is satisfactorily carried out, and if the patient be otherwise sound,

he ought quickly to regain strength and weight. The abscess cavity begins to shrink at once, and if the ureter be pervious, and if there be no obstruction to the escape of urine down to the bladder, the wound may close within a few weeks.

It need hardly be mentioned that where malignant disease in the pelvis is the cause either of a hydronephrosis or pyonephrosis, any operative interference beyond a simple aspiration or incision is not to be thought of.

The operation for the removal of a suppurating kidney resembles that for hydronephrosis; special care must be taken to prevent escape of pus into the peritoneal cavity or into the cellular tissue.

Hydatid Disease of the Kidney.

The frequency of this diseased condition varies greatly in different parts of the world, as is the case with hydatid disease in other parts of the body. In this country it is somewhat rare, and it appears to be more common in England than in Scotland. Enlargements from this cause are found more frequently in the left than in the right kidney. The disease is situated either deeply in the substance of the organ, or superficially underneath the capsule. In the former situation these growths seldom reach to any great size, as the cysts easily make their way into the pelvis of the kidney, and passing down the ureter, are discharged through the urethra.

Symptoms.—These may be altogether wanting, and the disease may be discovered as a swelling due to a painless abdominal tumour, or may be seen on *post mortem* examination. When the growth is so situated that there has been a rupture into the pelvis of the kidney, the passage of daughter cysts and shreds of membrane down the ureter give rise to renal colic. Suppuration in the kidney may occur, and when this happens the abscess may burst into the lung, intestine, peritoneal cavity, or ureter; even without suppuration there may be discharge of the cyst in any of these directions.

Diagnosis.—There may be simply a cystic tumour of the kidney, which is sometimes smooth and regular, at other times irregular, in outline. Fluctuation may be present, or it may be masked by the tenseness of the cyst. The hydatid thrill, of which so much has been made, is seldom to be felt; in other respects the swelling does not differ from any other kidney tumour. Should the tumour be aspirated, microscopic examination ought to settle all doubt as to the nature of the growth, except in rare cases of acephalous cysts, where no hooklets are present. Attention may be drawn to hydatid disease of the kidney by attacks of renal colic, and one or repeated examinations of the urine will show what it is that has been passing down the ureter. In such a case no actual cyst may be found on abdominal examination, but the kidney will be observed to be more or less enlarged.

The necessity for great care in the examination of the urine, or of fluid withdrawn from a cyst by aspiration for hydatid hooklets, is well emphasised by the following case. An old woman, nearly sixty years of age, was admitted to the Royal Edinburgh Infirmary on account of an abdominal swelling. The fluid was aspirated, and hooklets were supposed to have been seen by the house physician, thus apparently rendering the diagnosis certain. But for the presence of the hooklets the diagnosis would have been that of ovarian tumour; and at the operation two ovarian tumours were discovered, both having opened up the broad ligaments.

Treatment.—This will depend on whether the cysts are passing away through the ureter or not. Where there is a distinct abdominal cyst, giving rise to symptoms which call for interference, the first thing to do is to aspirate, using a fine needle. As has been already pointed out, the needle is to be introduced at the highest point of the tumour, the patient lying on the back; and there must be no exception to this rule, though the usual advice is given to puncture through the loin. The whole of the fluid which is removed is allowed to settle for twelve

hours, and the deposit is to be examined by the microscope as usual. Should the fluid reaccumulate and cause much suffering a more formidable course will have to be recommended, and the treatment will lie between incision and drainage through the loin—lumbar nephrotomy—and removal of the entire growth, including the kidney, from the front. Of these two methods the choice ought always to be made of lumbar incision and drainage. When the passage of the daughter cysts down the ureter gives rise to much discomfort, and even though no tumour be present, the kidney must be incised from the loin, and the contents thoroughly cleared out and drained.

Solid Tumours of the Kidney.

Solid tumours are best divided into two great classes, simple and malignant. The simple consist of the tubercular or strumous kidney, and these become in their later stages more of the nature of a cystic than a solid tumour. Other forms of solid growths are the fibromata, with the degenerations into fibro-cysts, and lipomata, but these growths are rare, and may almost be classed as surgical curiosities.

The enlargements connected with lymphadenoid disease, and also those due to syphilis, are of no surgical importance.

Tubercular or Strumous Disease of the Kidney.

Tubercular or strumous disease of the kidney may be considered together, but tuberculosis, due to a general condition, does not come within the range of a surgical work.

Taking the two diseases as one, we find that it occurs more commonly in children and adults, and is not seen so frequently in later life. The disease may attack one kidney, and when both are found to be affected it is probable that the disease has spread from one to the other through the medium of the bladder. There is no special reason why tubercle should attack the kidney,

but it most likely obtains a footing in the organ when the vitality is temporarily lowered owing to a chill, in a subject with a predisposition to tubercular disease.

Symptoms.—These are at first extremely slight, scarcely more than some little uneasiness in the region of the kidney. As the disease progresses the uneasiness becomes worse until actual pain is complained of, there is also tenderness in the affected side, hæmorrhage caused by the ulceration and breaking down of the tissues, and with this there may be attacks of renal colic. Examination of the urine shows that it contains pus and shreds of renal tissue, and that it has lost its natural acidity. Usually there is frequency of micturition ; after a time the bladder itself becomes irritated, and this is accompanied by a greatly increased desire to pass water and increase in the pain. Sometimes instead of passing water too frequently there may be suppression. In fact the whole train of symptoms in a very marked degree resembles those due to the presence of a stone. There is a certain amount of difference in the character of the bleedings ; in tubercular disease the losses are irregular, and are not so apt to follow exertion as is the case when a stone is present. As the disease progresses the kidney enlarges, and after a time can be easily felt between the two hands. In the early stages the patient may not present any of the appearances commonly associated with tubercular disease, and there may .be no afternoon rise in temperature. Later, the patient becomes thin, the expression is anxious, there is fever and sweating at night, but these symptoms are also set up when a stone, accompanied by suppuration, is present.

The only absolutely certain diagnosis of the disease is made when the tubercle bacilli are discovered on microscopic examination. These may not always be found, but the best and most simple method of examining for them is similar to that recommended when peritoneal fluids were described. A kidney affected by this disease may become caseous, and give rise to no further trouble.

Treatment.—General treatment here, as in tuberculosis elsewhere, consists in improving the state of the general health, and the local treatment will lie between nephrotomy and nephrectomy. Puncture of a kidney which is supposed to be tubercular can never be advisable, for it can never by any possible chance result in recovery. Another reason why this should not be done is, that unless the kidney be very much enlarged, it would be impossible to aspirate it from the front, and the reasons for vetoing this slight operation from the loin have been given elsewhere. The aspiration of a strumous or tubercular kidney from the loin would result, unless a very fine needle were used, in some leakage into the cellular tissue, and this would be followed by an attack of inflammation, probably running on to the formation of a perinephritic abscess.

It is almost impossible to give more than general directions for differentiating those cases of this disease which require incision and drainage from those which are best treated by removal of the kidney.

The chief guide must be the length of time that the disease has been in existence, as shown by the symptoms; and by the quantity of pus which is being passed. In the consideration of all these features it must be understood that only one kidney is affected. If the disease be recent, the symptoms slight, and the quantity of pus passed in the urine not great, it is reasonable to expect that as yet there has not been much destruction of kidney tissue, and an attempt to preserve a fairly healthy organ is worth trying. In such a case incision and drainage is the proper treatment, but it is very necessary to exert great care in coming to this conclusion, for if the operation do not result in a cure, a sinus remains with resulting adhesions, which will necessarily complicate any future attempt at removal.

When the case is one of old standing, and when there is much suppuration, it is useless to expect that incision and drainage will be followed by complete recovery; for, even if the suppuration ceased and the disease were arrested, the remains of

the kidney would be of little use, and would always remain a source of danger.

When the disease has advanced a step farther, and the renal abscess has ruptured into the cellular tissue, it is best not to attempt the removal of the kidney at once, but to reduce the surrounding swelling and infiltration by drainage, and thus at the same time allow of improvement in the general condition of the patient. When there is an abscess both in the kidney and in the cellular tissue surrounding it, a free incision is to be made and the finger passed into the wound, so as to make sure that the opening through the kidney is of sufficient size to allow of free drainage from the bottom of the wound. At the same time any band or septum which might prevent the free escape of the pus is to be broken down.

Malignant Disease of the Kidney.

Following the plan adopted in this work we have classed cases of sarcoma and of carcinoma together under the head of malignant disease. For all practical purposes this is quite sufficient, and it may simply be stated that primary sarcoma occurs more frequently in children and carcinoma in adults. With secondary malignant disease we have nothing to do here. In children the disease may be congenital, in others it seems that it may be lit up by the irritation caused by the presence of a stone, or it may be due to a blow or other injury, especially in those who are predisposed to malignant disease by heredity.

In children there may be no symptoms at first, or even when the tumour is of some size, and during the whole course of the growth there may be nothing to draw one's attention to the existence of renal disease. It is not uncommon to find that the symptoms are due to the pressure of the growth, and to the wasting which occurs in the later stages.

In the adult also it is not infrequent that the presence of a swelling in the abdomen first directs the attention of the patient

to the disease. The symptoms are hæmorrhage and pain, the latter being the more common, and it radiates in the way that the pain of malignant disease usually does. The tumour is seldom tender to the touch, hæmorrhage may be entirely absent, and the general health is rarely affected until the disease is far advanced and beyond the reach of surgical skill. In common with other diseases of the kidney there may be more or less irritability of the bladder; and, in one case which came under our notice, a vesico-vaginal fistula had actually been made, the condition of the kidney having been entirely overlooked.

Examination of the urine occasionally discovers the presence of malignant-looking cells, but frequently no such information can be obtained.

Treatment.—In young children it is doubtful whether it is ever right to operate ; indeed, such operations must be looked on more as surgical possibilities than as operations of advantage to the patient. The disease returns quickly if the primary result be successful, and the little patient gains little or nothing by the operation.

In the adult removal of the kidney, when the case is seen early enough, is the proper course to pursue.

The operation is decidedly more difficult in the case of a solid as compared with a cystic tumour, the difficulty arising chiefly in securing the renal vessels. The incision is to be made through the linea semilunaris, the length varying with the size of the tumour, and being necessarily longer than in those cases where the tumour can be reduced in size by tapping. The peritoneum is raised up, as has always to be done for safety when opening the abdomen, and here it is specially necessary, as troublesome bleeding might result if the kidney tumour were injured. The hand is passed into the abdomen and the other kidney is examined. This precaution must never be omitted. A healthy, or what at least appears to be a healthy kidney, having been discovered, the operation can be proceeded with. The peritoneal cavity is first shut off with sponges as far as possible.

The peritoneum covering the tumour is next to be opened; this is best done with scissors, as there is no advantage in tearing it, for it is undesirable to cause any more bruising than is absolutely necessary. This opening should be to the outside of the colon, and the peritoneum on its inner side must not be interfered with, because the vessels for the nutrition of the bowel are situated in this layer of the mesocolon, and their destruction would be followed by gangrene of the intestine.

When there has not been any inflammation the enucleation of the tumour from the surrounding cellular tissue is not difficult, so long as attention is paid to keeping close to the tumour. This is easily done when the tissues are not matted together, but when this is the case very special care must be taken not to lose touch of the tumour itself. As a general rule it is best to enucleate towards the main vessels at the aorta, forceps being used to arrest bleeding during the separation. Having succeeded in enucleating the tumour all round until the tissues near the renal vessels have been reached, great care must be taken to avoid injuring the aorta or the vena cava. The vein is more liable to injury than the artery, especially if the tumour be on the right side. The artificial pedicle which has been formed is to be transfixed, and for this purpose an aneurism needle is the best instrument. It is of the greatest importance that no traction should be made on the tumour when the aneurism needle is passed or the ligature tied, for it would be easy to include a piece of the vena cava in the ligature. The point of transfixion is to be as near the kidney as will allow of the complete removal of the disease, and at the same time there must be room between the ligature and the kidney to permit of there being a sufficient length of the pedicle beyond the ligature to prevent slipping, and also if possible to allow of a narrow-bladed pair of forceps being fixed on to the pedicle close to the kidney to prevent the escape of the blood from the tumour.

When the pedicle has been tied it is to be very carefully divided close to the forceps by short cuts of the scissors. In

this way one can be certain that the pedicle is securely tied before it is completely divided.

During some stage of the enucleation the ureter will have been reached; it is to be divided between forceps and the divided ends at once rendered aseptic. This may be done by rubbing in a little perchloride of iron, or washing with a strong solution of corrosive sublimate. Owing to the somewhat irregular distribution of the blood supply, one or more large arteries may be met with during the separation of the tumour. All bleeding vessels must be tied, the sponges are removed from the abdomen, and the cavity of the peritoneum is to be sponged out only if there have been any escape into it. The edges of the posterior layer of the peritoneum are simply allowed to fall back, and the question of drainage has to be considered. In an ordinary simple case it is not necessary to leave in a drainage tube, but should there be oozing going on, should there have been extensive enucleation in a weak subject, or should there have been any escape of pus or urine, it is advisable to drain. A short wide glass or rubber drainage tube is to be passed into the cavity from which the kidney has been removed, and is fixed in the wound as in any abdominal operation.

Before the stitches are secured the ureter is to be tied and fixed into the wound; on the whole this seems to be safer than allowing it to drop back into the abdomen.

Pyelitis.

Pyelitis consists of a suppuration in the pelvis of the kidney. It differs from a hydronephrosis in this, that no appreciable tumour is usually to be felt, and that the pus is always found in the urine, causing as a rule irritability of the bladder. The exact cause is the spread of some septic poisoning from the bladder to a not altogether healthy pelvis of the kidney.

Surgical Kidney or Pyelo-Nephritis.

This consists in inflammation followed by suppuration through the whole substance, usually of both organs, and it is not a condition which can be interfered with surgically.

Injuries of the Kidney.

Injuries may result either directly, as from a gunshot wound or a stab, or more indirectly, as when a wheel has passed over the body, or when the patient has fallen in such a way that the abdomen is struck, or merely as a result of violent concussion.

A gunshot wound will be discovered after the abdomen has been opened, if the principle be carried out that when there is a bullet wound of the peritoneum the cavity must be opened. If any but a slight injury be found the only treatment would be to remove the kidney, but if the injury be slight, and it be possible to stitch over the opening in the posterior layer of the peritoneum, an opening for drainage may be made through the loin. The peritoneum should be washed out and drained, as there may have been an escape of urine. The injury which is more likely to be met with is a laceration of the kidney without the presence of an external wound. The laceration may be in the kidney itself inside the capsule. In this case the prominent symptom would be hæmorrhage passing down the ureter into the bladder, possibly renal colic, and some pain and collapse if the quantity of blood lost were great. Along with these there may be a distinct swelling in the position of the kidney.

Treatment.—The treatment consists in absolute rest, and in the administration of morphia if required. An ice bag may be placed on the side, and if there be retention the water will have to be drawn off. This plan of treatment is much more likely to save the life of the patient than any operative interference. A patient between forty and fifty years of age, standing on a chair on a table, fell and struck her side against the end of a

sofa. She became very much collapsed, and for some days passed a large quantity of bright coloured blood mixed with the water. The amount of blood gradually diminished, and by the end of three weeks the water was quite free of it. The patient was simply kept in bed with ice to the side, and no other treatment was required.

A perinephritic hæmatocele sometimes results from an injury to the side. There is a history of the injury followed by pain and the appearance of a tumour, without any symptoms of disturbance of the kidney. The condition is a rare one, and may be very puzzling.

The treatment is similar to that of rupture. A gentleman living in the country, about fifty years of age, was kicked in the side by a horse. When he was seen some hours afterwards he complained of very great pain in the side, and a swelling as large as an adult head was felt reaching far into the loin, bulging out the side, and altering the shape of the abdomen. The patient was at first very much collapsed, but this was passing off. The treatment consisted in keeping the patient absolutely at rest in bed, and in administering sufficient morphia to soothe the pain. Under this treatment the swelling gradually decreased, and within four months had entirely disappeared.

A second example of this rare condition is worth noting. A young man twenty years of age had run up against a stake while playing tennis. He was at first doubled up with the pain, and when seen nearly three months after the injury was entirely confined to bed. He was losing flesh, the pulse kept at about a hundred, and the temperature was a little over normal. A variety of opinions had been given as to what the swelling might be, and an exploratory incision had been very strongly urged. A favourable prognosis was given, and although no special treatment was advised, the young man was so well that he passed the medical examination for the army about a year afterwards.

CHAPTER XI.

THE SPLEEN.

Surgical Anatomy.

The spleen is situated high up in the abdomen, and lies deeply in the left side of the costal zone. For the most part it occupies the left hypochondriac region, with its long axis directed downwards and outwards, and its upper end considerably nearer the mesial plane than its lower end. Its upper end crosses the mid-Poupart line, and so encroaches on the epigastric region. The outer surface which looks outwards and backwards is in contact with the diaphragm, by which it is separated from the ninth, tenth, and eleventh ribs, but the upper part of this surface is also separated from the chest wall by the thin lower margin of the left lung. The inner surface presents two well-marked concave areas, separated from each other by a ridge which runs from the upper to the lower end of the organ. The area posterior to this ridge is in contact with the left kidney, while the area anterior to the ridge is mostly in contact with the posterior aspect of the cardiac end of the stomach; but the tail of the pancreas and the splenic flexure of the colon also leave their imprint on this surface. In consequence, the lower end of the organ is flattened and rests upon the phrenico-colic ligament, which is a fold of peritoneum attaching the splenic flexure of the colon to the diaphragm. The upper end of the spleen usually abuts against the left suprarenal capsule. The posterior border is rounded and smooth; the anterior border presents

several notches, and their presence assists greatly in the diagnosis of enlarged conditions of the organ. Its dimensions are subject to great variations, but it is usually about five inches in length, three or four in breadth, and rather more than one inch in thickness.

The gastro-splenic omentum, which may be considered as a lateral prolongation of the small omentum, passes from the stomach to the spleen at the hilum, which is situated on the gastric impression. At this slit the blood vessels, which are enclosed in the gastro-splenic omentum, pass into and out of the spleen. The artery which supplies the spleen is the largest branch of the cœliac axis. It is known as the splenic artery, and passes along the upper border of the pancreas, being very tortuous, and terminating at the hilum of the spleen in five or six branches. The splenic vein assists in forming the portal vein. The gastro-splenic omentum is surgically known as the pedicle of the spleen. The lieno-renal ligament is a fold of peritoneum which attaches the spleen to the anterior surface of the left kidney.

The spleen is an organ which does not often require surgical treatment. The operations which may be performed on it are splenotomy, that is to say, simple incision ; and splenectomy, or removal of the whole gland.

Inflammation and Suppuration.

An inflammation of the spleen is seldom seen in this country, it is usually caused by malarial poisoning. The results of the inflammation are, however, met with in the form of suppuration in the organ. Such an abscess may open through the skin, or the pus may pass into the left pleura, stomach, or transverse colon ; or in some cases the abscess may burst into the peritoneal cavity, or into a part of it shut off by adhesions.

Symptoms.—The chief symptom of an acute attack of inflammation of the spleen is pain in the left side, at first acute ; and

as the organ enlarges, it becomes of a dragging character. There is some fever, and when suppuration commences it is ushered in by a feeling of chilliness. Sometimes an abscess may form in the spleen without any marked symptoms to draw attention to the condition of the gland.

Diagnosis.—The diagnosis of abscess of the spleen is made by the history of the acute inflammatory attack, the feeling of weight and discomfort, the sallow appearance, the presence of a tumour appearing from under the costal margin on the left side and especially when notches can be felt at the right side of this swelling.

Treatment.—When it is proposed to open the abscess, the incision should be made in the longitudinal direction over the most prominent point, or somewhat above it, as the spleen will be drawn upwards when the pus is removed, unless there be adhesions. The length of the incision will be from two to three inches. When the surface of the spleen is exposed, unless it be adherent to the abdominal wall, as is often the case, the abscess is to be aspirated after sponges have been packed round the site of the opening; and, as soft friable tissue is being dealt with, the air in the bottle must not be exhausted too forcibly. Before removing the cannula, an incision is made into the abscess cavity, and when this has been done, the edges are to be stitched to the abdominal wall in the same way as an abscess of the liver, the sponges in the peritoneal cavity having been previously removed. A large-sized rubber tube is left in to drain the cavity from the bottom; and should there be any bleeding from the cut surface of the spleen, pressure or a chain of stitches may be used to arrest it. Should it not be possible to fix the spleen to the parietal wall the whole organ will have to be removed.

Cysts of the Spleen.

These cysts are very rare, and a diagnosis has seldom been made before operation. They are very liable to be mistaken for

cysts of the kidney, and with the exception of the want of evidence of kidney disease, there are no symptoms which will draw attention to the spleen, unless the case be seen very early.

Hydatid disease of the spleen is also very difficult to diagnose, and certainty can only be arrived at by finding hooklets in the fluid withdrawn. The position of the cyst, and the direction in which the swelling disappears after aspiration, might indicate the primary situation of the disease.

Treatment.—The treatment of cysts in this part of the body consists in withdrawing the fluid with the aspirator through a fine hollow needle inserted into the sac. If the sac refill, incision and drainage must be carried out on the same lines as in the case of an abscess; but the risk of hæmorrhage from the pedicle is so great that it is advisable to avoid total expiration if a cure can be otherwise obtained.

Displacements.

The spleen is one of those organs which may be very much displaced, sometimes without any particular reason, sometimes from the pressure of an effusion in the left pleura. When the spleen is displaced, it may become adherent in its new position, and this renders diagnosis difficult. In one case it was found to be situated in the left iliac fossa, having been pushed into this position by an enormous effusion in the left pleura. When the spleen is much displaced, the pedicle may become twisted, and peculiar stomach symptoms may be caused by the dragging downwards of that organ, as it is connected to the spleen by the gastro-splenic omentum. When the spleen has become fixed in a new position, and has become enlarged, it is extremely unlikely that a diagnosis will be made. If the displacement be giving rise to much trouble, the only treatment is to remove the organ if it cannot be pushed back into its natural position, and retained there by a well-padded bandage.

Solid Enlargements.

These are usually due to leucocythæmia, to lymphadenoma, to waxy disease, to congestion in ague, during typhoid fever, and occasionally a simple hypertrophy with or without induration may be met with. The symptoms, which a solid enlargement gives rise to, are simply due to the size, unless there be any constitutional disease in addition. An enlargement due to leucocythæmia ought to possess no interest for the surgeon, except from the diagnostic point of view; for the removal of the spleen in this disease seems to have been practically always fatal. It is well known that there is a great tendency to hæmorrhage after any operation performed on a leucocythæmic patient, and it is unlikely that removal will improve the general disease.

The spleen may enlarge until it fills the whole of the left side of the abdomen, dipping down into the pelvis, and passing across the middle line to a very large extent. On examining the organ, one deep and several shallow notches will almost invariably be found on the right hand border of the swelling. The presence of these notches is only diagnostic when they are very well marked, for a doubtful notch may be occasionally met with in other growths. The lower part of the chest wall on the left side is bulged considerably outwards and upwards by the swelling, and the consistency of these enlargements is extremely solid and firm. Percussion gives an absolutely dull note where the tumour comes out underneath the costal margin on the left side. On percussing downwards the note is found to be less dull until the lower margin of the tumour is reached, when an almost tympanitic note is obtained; this is due to the shape of the organ, being thicker above and gradually thinning as it descends. Posteriorly a clear note may be obtained on percussing the back in the position of a normal spleen. A patient who was supposed to have an ovarian tumour was sent into the Royal Infirmary, Edinburgh, but on examination she

was found to have an enormously enlarged spleen due to leucocythæmia. The enlargement was so great that the tumour could be felt from the vagina; and the notches, of which there were three, were situated almost in a line with the anterior superior spine of the right ilium. The case proved a puzzling one to a number of abdominal surgeons who happened to be visiting Edinburgh,—none of them had ever seen a spleen of such magnitude. Some two years after, the diagnosis was confirmed by *post mortem* examination.

The following case illustrates the difficulty which may be met with in diagnosing the exact situation of a tumour in the region of the spleen. A lady twenty-eight years of age had the ovaries removed, and one of the broad ligaments fixed in the wound by a clamp. This was in 1883, and after she had undergone a great deal of treatment for pelvic disease. She became perfectly well, but in 1887 she began to complain of pain in the left side, and a small tumour was discovered below the ribs. The kidney, which was pushed down, was felt to be unconnected with it in any way by Dr. Keith, and independently by Sir William Jenner. The tumour steadily increased in size, and by the summer of 1888 it filled a large part of the left side of the abdomen, reaching below the umbilicus, raising the chest wall on that side considerably, having an ill-defined notch on the right side, and the note on percussion resembled that obtained in enlargements of the spleen. Sir James Paget and the late Sir Andrew Clark both saw the patient and confirmed the diagnosis of enlargement of the spleen. The general health of the patient was good, but she could not walk any distance. The experiment was made of passing the galvanic current through the tumour, and at first it seemed as if this treatment would prove very successful: the tumour diminished in size so much that the lady's maid had to take in her dresses five inches, and there was marked improvement in walking. After a time she went home, the tumour began to increase, electricity was again tried, but without benefit. She returned to London

some time afterwards, consulted another surgeon, who advised immediate removal of the growth; and it is interesting to note that he thought the scar made by the clamp some years before had been caused by a drainage tube! The tumour turned out to be a sarcomatous growth unconnected either with the spleen or the kidney! The patient had a long illness, recovered, and was fairly well for a short time, but suffered very greatly before her death some two years after the operation.

In every case of enlargement of the spleen it should be a rule to examine the blood; and, if an increase in the number of white blood corpuscles be found, the case must be handed over to the care of a physician.

Increase in the size of the spleen, due to simple hypertrophy, is slow; and, unless the enlargement be giving rise to a considerable amount of discomfort, there is no necessity to advise any further treatment than the support and fixation which may be obtained by a light abdominal belt. When the size is great, or there are distressing symptoms, removal of the organ is the only course to pursue; but this is an operation which ought not to be undertaken lightly, as the risk is considerable.

Splenectomy.

The preparations are similar to those of any abdominal operation. The incision has been usually made in the middle line, and when the organ is much enlarged and the abdominal wall is stretched, an opening made in this position will be as convenient as any. When the size of the spleen has not caused much distension, the incision should be made through the left linea semilunaris. If no adhesions be found when the peritoneum is opened, the tumour is to be pressed out, a start being given by passing the hand into the abdomen, and drawing up the growth from behind. The lower part must be brought out first, and as soon as it becomes engaged in the wound, the

complete extrusion of the tumour is effected by depressing the abdominal walls over it. It is better to get it outside in this way than to draw much on the organ itself as with a corkscrew, because the greatest care must be taken to avoid dragging on the pedicle. When adhesions are present, they must be treated as in any other situation, and the tumour itself must not be injured. The treatment of the gastro-splenic omentum or pedicle requires to be carried out with particular care, as there is great tendency to hæmorrhage after the operation has been completed. It has to be tied very much as a pedicle elsewhere, but it is often difficult to reach it without dragging on the vessels; the best plan is to transfix with an aneurism needle passed from behind forwards, each half is then tied separately, and the double ends of each tied together. After this has been done the pedicle is divided, leaving a sufficient amount of tissue beyond the ligature to prevent slipping. When there is any doubt, it is well to fix a pair of forceps on to the pedicle before the spleen is removed; and after division to tie the open mouths of the vessels separately. If it be difficult to ligature the pedicle in this way, it may be more easily accomplished by clamping the pedicle close to the spleen with a pair of large locking forceps; and then, after the spleen has been removed, the tissues below the forceps can be transfixed and tied. The only objection to this plan is the difficulty in having the pedicle completely relaxed, because the blades of the forceps keep it stretched out to a certain extent. Each case will have to be treated according to the exact condition of the pedicle, more care being taken than usual on account of the great risk of hæmorrhage in this situation. What has to be attended to chiefly is to avoid drawing on the tumour, because traction alone may cause alarming symptoms, and when a pedicle is stretched a ligature cannot be tied so tightly. The suspensory ligament having been ligatured and divided, the tumour can be completely removed. Sponging may or may not be required; it is not likely that a drainage tube need be left in, and except

for the fear of hæmorrhage, which may occur during the first few hours, there is nothing peculiar about the after treatment.

Malignant Disease.

In malignant disease it is doubtful whether a diagnosis could be made. The symptoms are very much the same as those of simple enlargement, but the patient will probably show general signs of malignant disease. If the diagnosis has been made before the disease has spread, or numerous adhesions have formed, the growth should be removed. The disease is more liable to be found when an exploratory incision has been made on account of a tumour on the left side, which is either growing rapidly, or is markedly interfering with the general health.

Wounds.

A wound of the spleen may be found when an exploratory incision has been made, on account of a penetrating wound of the abdomen. Serious wounds of the organ may not give rise to much hæmorrhage if the substance which has caused the wound be not withdrawn. Instances have been known, where the removal of a body, such as a piece of rib, has been followed by fatal hæmorrhage.

If the injury to the spleen be serious, the best course to pursue is to remove the whole organ; should it consist of a slight wound of the surface, it may be sufficient to stop the bleeding either by pressure or by the introduction of a few sutures. In any case, a diagnosis will not be made with certainty until the actual condition is discovered. Fortunately no special instruments or appliances are required, as the removal of the organ must be determined on immediately if the injury be severe.

Operations of all kinds on the spleen have been extremely rare, and it is probable, in the large majority of cases, that a

diagnosis is not made beforehand. The general mortality has been so great that an operation which may have to end in the removal of the spleen is one which requires very grave consideration; but, where the symptoms are very distressing, or the life of the patient is endangered, it may become absolutely necessary to interfere surgically.

THE PANCREAS.

Surgical Anatomy.

The pancreas rests upon the posterior wall of the abdomen behind the stomach, and is placed in front of the first and second lumbar vertebræ. This organ projects into the abdominal cavity, but is situated entirely behind the peritoneum. It consists of a head, a body, and a tail. The head forms its right extremity and lies within the horse-shoe curve of the duodenum resting upon the crura of the diaphragm, the inferior vena cava, the aorta, the superior mesenteric vessels, and the commencement of the portal vein ; while in front it is covered by the posterior wall of the small sac of the peritoneum, and is in close proximity to the pyloric portion of the stomach. The central part or body lies behind the posterior wall of the small sac of the peritoneum and rests on the anterior surface of the left kidney, the left suprarenal capsule, and the splenic vein. The tail extends as far as the inner surface of the spleen. The transverse mesocolon is attached to the front of the body of the pancreas along the line which separates its anterior from its inferior surface. The cœliac axis is seen immediately above the pancreas, and the common bile duct passes behind its head on its way to open into the duodenum. It receives its blood supply from the superior and inferior pancreatico-duodenal arteries, and also from the pancreaticæ parvæ and pancreatica magna branches of the splenic artery.

The pancreatic duct begins near the tail of the organ, and passes from left to right, gradually increasing in size. It receives numerous tributaries during its course, especially a large one from the lower part of the head, and opens into the duodenum in conjunction with the common bile duct, by piercing the inner and posterior aspect of its descending or second part.

To expose the pancreas, throw upwards towards the ribs the

great omentum with the stomach and transverse colon ; then cut through the inferior layer of the transverse mesocolon ; and afterwards divest the surface of the pancreas from the peritoneum, which constitutes the upward prolongation of the superior layer of the transverse mesocolon.

The surgical treatment of the pancreas is practically limited to the treatment of cysts, though various directions have been given in cases of cancer, abscess, etc., but in those conditions the directions may be looked upon rather as of theoretical than of practical importance.

Cystic Enlargements.

Cysts of the pancreas are fortunately very rare, for the diagnosis is by no means easy. Some grow rapidly, others with extreme slowness ; digestion may be interfered with, and this may be shown in the character of the stools ; but on the other hand, these cysts may give rise to no symptoms.

The position of a cyst in the early stages will depend on what part of the organ it has grown from ; as it enlarges it may become completely central, and when of considerable size may be mistaken for an ovarian tumour, a hydronephrosis, hydatids, or a circumscribed collection of peritoneal fluid.

Treatment.—This consists in incision and drainage. When the fluid is removed by aspiration it quickly refills, and an attempt to remove the cyst is usually accompanied by great danger.

The operation of incision and drainage is performed in the following way :—An incision two or three inches in length is made over the tumour in the middle line. When there are no adhesions in front, the omentum is seen as soon as the peritoneum is divided, and is cut through with scissors, all bleeding points being tied. The trocar, preferably attached to an aspirator, as the fluid may be thick, is thrust into the sac ; as soon as the fluid is emptied, the sac wall is drawn through the outside

wound and connected to it by stitches, as much of the sac being removed as can be done without causing tension. Should firm adhesions exist in front, the incision is made down to the sac, and the contents removed by the aspirator. The opening is made of sufficient size to admit a large drainage tube, and the adhesions take the place of stitches. It is better not to attempt to remove any of the cyst wall in the adherent cases. A large sized drainage tube is to be used in every case, and a second, if necessary, should there be pouching. At first there may be very free discharge, which will be apt to cause digestion of the skin, if the cyst have been caused by a blocking of the pancreatic duct. In such a case some greasy substance must be applied around the wound. As the discharge lessens and the cyst closes up, the drainage tube, which may have been reduced in calibre, is to be gradually shortened. The fistula may or may not remain permanently.

SECTION II.

THE SURGERY OF THE ABDOMEN PECULIAR TO WOMEN.

CHAPTER I.

TUMOURS OF THE OVARY.

Surgical Anatomy.

The ovary varies in size with age, and during its active life in relation to a menstrual period. The average weight is from sixty to a hundred grains, the length one and one-third inch, and the greatest diameter three quarters of an inch. At or about the time of a menstrual period it is much swollen, and the corpus luteum which is formed has been sometimes mistaken for an ovarian hæmatoma or blood cyst.

The ovary is situated at the upper and back part of the broad ligament, and is covered by its posterior layer, except

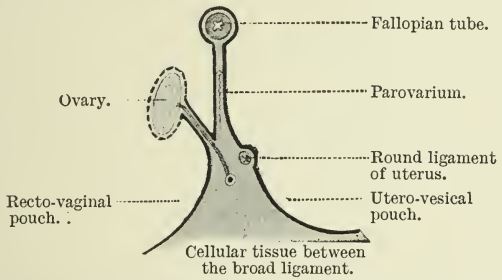

Fig. 20.—Diagrammatic Antero-Posterior Vertical Section of the Broad Ligament, showing the normal relation of the organs enclosed within the peritoneal folds (Hepburn).

along the line of the hilum. At the same time it should be noted that the cells characteristic of peritoneum are replaced by the columnar (germinal) epithelium.

Blood vessels and nerves pass into it at the hilum from

between the layers of the broad ligament. There is therefore a direct communication between the hilum of the ovary and the pelvic cellular tissue. In the annexed illustration (Fig. 20) is represented, very diagrammatically, the relation of the ovary to

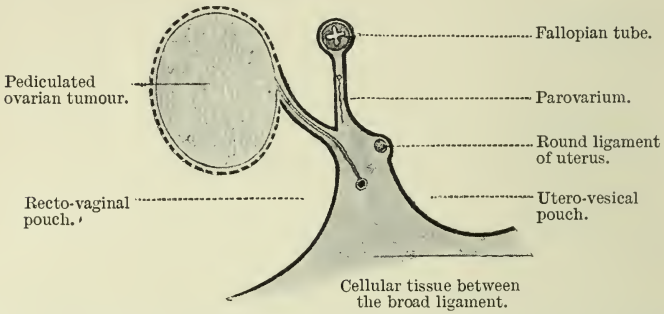

Fig. 21.—Diagrammatic Antero-Posterior Vertical Section of the Broad Ligament, representing a pediculated ovarian tumour with a long pedicle. Continuous line indicates peritoneum, the dotted lines columnar epithelium of ovary. (Hepburn.)

the broad ligament and pelvic cellular tissue. The pedicle of an ovarian tumour consists of that part of the broad ligament to which the hilum is attached, along with the cellular tissue, blood vessels, and nerves. It will be easy to understand how, if the part of the

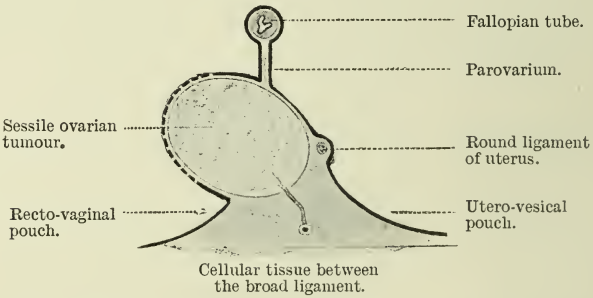

Fig. 22.—Diagrammatic Antero-Posterior Vertical Section of the Broad Ligament, representing a sessile ovarian tumour. The peritoneum is shown by a continuous line, the columnar epithelium of the ovary by a dotted one. (Hepburn.)

ovary farthest away from the broad ligament become enlarged, the pedicle is formed, and how it may be even several inches in length. On the other hand, should the ovary enlarge where it is in connection with the cellular tissue of the broad ligament it is evident that instead of drawing part of the broad ligament

upwards and into a pedicle, it may push its way between the folds of the broad ligament itself, and thus become sessile, there being no pedicle, the anterior and posterior layers of the broad ligament being stretched more or less over the tumour.

When the diagnosis of this latter condition comes to be considered, it will be understood how a tumour, distending one broad ligament, will displace the uterus; and it will also be easily seen that the operation will be a more formidable one than when there is an ordinary pedicle.

These tumours may be divided into single cystic growths, tumours composed chiefly of several cysts, tumours made up principally of a mass of small cysts, semi-solid tumours, solid fibroid tumours, dermoid tumours, and malignant tumours. They are unlimited in size, and with the exception of the dermoids, usually grow rapidly. In describing the symptoms and diagnosis of tumours varying so much in consistence and in size, it is impossible to describe in words all the variations which may be met with, and it will be found in practice that a diagnosis is made principally from the sensations conveyed to the fingers. This can only be arrived at by experience.

Signs and Symptoms.—An ovarian tumour is *per se* a painless growth. At any stage of its history it may give rise to pressure symptoms, and it may also cause attacks of inflammation in the abdomen. The rapidity with which these tumours increase in size varies greatly; as a rule they are seldom discovered until they are large enough to affect the size of the abdomen. They are not commonly seen in the early stages when they are limited to the pelvis, and little is therefore known of their rate of increase while of small size.

After the tumour has grown up to the anterior abdominal wall, the increase in size may be very rapid, a few days sometimes showing a marked difference. Usually the growth is not so rapid, but a month in the life history of an ovarian tumour shows a marked increase. On an average it may be said that the life of a patient is worth two years, perhaps three, after an

ovarian tumour has become abdominal, and during the half of this time the patient lives in misery. In exceptional cases an ovarian tumour may grow very slowly, and the patient may live many years in comfort without any surgical interference being absolutely necessary. Until an ovarian tumour is of such a size that it has filled the entire abdomen and is raising the ribs, it may not affect the general health in any way. When it begins to press upwards on the diaphragm the patient suffers from the size, and the health becomes affected. The whole body becomes thin, and the countenance of the patient is drawn and anxious; the pulse quickens, and the respirations become shallow and laboured. This latter symptom is not a very marked one unless the tumour be enormous.

The position of the tumour, when it is of small size, not extending much above the umbilicus, is almost invariably to one or other side of the middle line, but as it grows and fills the abdomen, it becomes central.

The umbilicus, except in the early stages, is flattened out, and enlarged veins in the abdominal wall used to be frequently seen when the tumours were allowed to grow to a large size.

There is one symptom which is almost more to be relied on than any other—it is the emaciation of the chest and arms in comparison with the lower part of the body. In the small tumours and in those of no great size, not perhaps more than 10 lbs. or 20 lbs. in weight, the upper part of the body is thin, the abdomen is distended, and the size of the legs is little or not at all reduced. With the very large tumours this symptom is lost, as the legs as well as the upper part of the body emaciate.

The first thing to make out is the relation of the growth to the uterus. The tumour may not be felt by the examining finger, and the uterus may be found freely movable. With the finger on the cervix, lateral and upward pressure must be made with the other hand on the abdominal swelling to determine whether the growth is free from the uterus or not. Downward

pressure of an ovarian tumour does not give any information, because, no matter what the connection, it must affect the position of the uterus if it be pressed against it. When the tumour is felt in the pelvis, it may be situated either in front, or behind, or to one side of the uterus, or it may be found to have retroverted the uterus, or the tumour may have filled the whole of the pelvis and pushed or drawn the uterus into the abdominal cavity.

When a tumour is fixed in the pelvis it gives rise mechanically to irritability of the bladder or sometimes to retention, and it may also partially obstruct the flow of urine from the kidneys. An ovarian tumour may cause additional pressure symptoms, there may be dropsical effusion into the lower limbs and sometimes into the cellular tissue of the abdominal wall, though this latter condition is due more frequently to some complication, which will be referred to later.

In the very large majority of ovarian tumours fluctuation will be made out at some part. This may be difficult to make out when the cyst is tense, especially if the walls be thick, and of course this sign will not be present when the growth is absolutely solid.

When the tumour is large enough to touch the abdominal wall, the percussion note is almost invariably dull from the upper part of the tumour down to the pubes, but a coil of intestine may run across the front of the growth.

Auscultation simply gives negative information.

It is never safe to rely on any one symptom alone, all must be taken into consideration. The one upon which most stress should be laid is the thinning of the chest and arms in comparison with the legs, and this is usually seen even in small tumours. A well-marked example of the importance of this symptom is given in the following history. A young lady twenty-nine years of age was seen in the beginning of 1890. Two years before, attention had been drawn to the presence of an abdominal tumour by an attack of pain, and at that time the growth extended to three

inches above the pubes. The patient was anæmic, she was not emaciated, the tumour swelled up markedly before every period, and the quantity of blood lost was greatly increased. A sound passed five inches apparently into the centre of the mass, which was very little larger than it was said to have been two years before. The diagnosis was doubtful, it lay between a uterine and an ovarian tumour. As a positive opinion could not be given the patient was sent home, as the treatment—by electricity or by operation—depended on the diagnosis. She returned in two months, the tumour had not increased in size, the monthly swelling was more marked, the menorrhagia was more excessive, but there was decided emaciation of the chest, and chiefly on this symptom the tumour was diagnosed to be an ovarian growth. It turned out to be a dermoid tumour.

Diagnosis.—The diagnosis of an ovarian tumour may be difficult, for the growth may consist of one fluctuating cyst, or of a tumour composed of several fluctuating cavities, or there may be so many small cysts that the growth is semi-solid, or it may be completely solid. It may be smooth and regular in outline, or it may present all kinds of irregularities on its surface. It may be of any size, from that of a billiard ball to beyond 100 lbs. in weight. It may grow with great rapidity, or it may appear to be completely stationary in this respect. Its position varies, sometimes it is more or less to one side of the middle line, sometimes completely central, or a small tumour may be fixed in the position of the kidney and with no apparent pelvic connection. On making a pelvic examination nothing abnormal may be felt; or the uterus may be partially fixed by a tumour out of reach; or a fluctuating or solid block of tumour may be felt behind, in front of, or on either side of the uterus. In a difficult case a diagnosis seems to be arrived at, not so much by any one sign pointing to ovarian tumour as by the whole chain of symptoms indicating ovarian disease more than anything else.

The effect produced by the presence of an ovarian tumour

on the menstrual functions is not of any assistance in coming to a diagnosis; there is usually no change, but there may be menorrhagia, and amenorrhœa is not uncommon when the tumour is of some size.

Differential Diagnosis.—The various enlargements of the abdomen will be taken up in detail, and will be examined with the purpose of giving as far as possible a differential diagnosis between such growths and an ovarian tumour.

First in order will naturally come enlargements of the uterus, as these are by far the most common even if pregnancy be excluded. The normal enlargement of the uterus will be taken first, for mistakes are common, and to overlook a pregnancy or mistake it for something else is a failure not easily forgiven by a patient. The history may mislead either intentionally or otherwise; if the former, it will be with the idea of putting off the evil day of confession as long as possible, or with the hope by misleading the doctor something may be done unawares for her benefit; if the latter, it will probably be in the case of a woman well up in years, who has had a family, and does not suspect that another is to be added to her flock. An unmarried lady thirty-six years of age, whose thigh had been amputated in childhood, complained of amenorrhœa; an abdominal tumour was found, and, although the question of pregnancy was thoroughly debated, the conclusion come to by three medical men was that the tumour was ovarian. An abdominal surgeon was written to and asked to come and remove the growth; he suggested that as there was not any particular hurry it would be better to wait and examine the patient again. This was done and the fœtal heart was discovered.

The mother of a large family, forty-seven years of years, and whose youngest child was eight, had not been very well for some time, when an abdominal swelling was noticed. The lady could hardly be brought to believe that she was pregnant until she could not mistake the movements of the child.

A mill-worker, nineteen years of age, was brought into the

Edinburgh Royal Infirmary by her doctor in July 1885. About the beginning of the year she had run the risk of becoming a mother, and the size of the swelling was that of a seven months' pregnancy. The cervix was soft and moved with the tumour, the outline was not well defined, and it was impossible to give a positive diagnosis. Time alone cleared up the matter, and a multilocular ovarian tumour was eventually removed. As the tumour was slightly ruptured, the tension had been taken off; and this along with a small amount of free fluid and the tense abdominal wall led to the difficulty in diagnosis.

When the fœtal heart is heard the diagnosis is certain; when for some reason it cannot be made out the most distinctive sign is a peculiar feeling of want of definition presented by the tumour. There seems to be no distinct outline, the swelling having almost the feeling of blending with the surrounding structures, and in the interior of this swelling irregular firm masses are felt. If one is so fortunate as to examine when the uterus contracts or relaxes, the diagnosis is nearly certain. The cervix may not be soft, it may not be affected by the movement of the tumour, the fœtal head may not be within reach, or if it is there may not be ballottement. This sign of ballottement may be well marked where there is a firm tumour surrounded by ascitic fluid. There are various other symptoms which, though by no means diagnostic when taken alone, yet go to weigh the balance more in favour of one condition than the other. We have for example sickness, a common symptom in pregnancy, more especially in its early stages, while it is not common in ovarian disease, and then only when the tumour is large enough to cause pressure. The expression is different, and thinning of the upper part of the body does not usually occur in pregnancy, the reverse being rather the case. Movements or supposed movements of the fœtus, enlargement of the mammæ, blue appearance of the vagina, are more indicative of pregnancy than of the presence of an ovarian tumour. The presence or absence of the menses is not to be relied upon.

A fibroid tumour of the uterus differs from an ovarian one in that it is usually more central. It is hard, often very hard, and there is no fluctuation, there is no emaciation of the chest and arms, the face is florid unless the patient be blanched by excessive hæmorrhage, the cervix is often altered in shape and position, and can be moved by alterations in the position of the tumour, and the sound may be passed many inches into the mass. Menstruation is often excessive, and is rarely absent, as is comparatively commonly seen in large ovarian tumours; the growth is comparatively slow, and the umbilicus is drawn in.

The fibro-cystic tumour of the uterus is much more difficult to differentiate, it resembles an ovarian tumour in almost every detail, but it is fortunately not often met with. It is frequently of rapid growth, fluctuation may be very distinct, the cervix may not seem to move with the tumour, there may be emaciation of the chest, there may be and usually is no change in menstruation, the sound may pass for a normal distance, and the umbilicus is usually flattened out. For the diagnosis of these tumours experience seems to be the only guide, and with the greatest care mistakes will every now and then occur.

A broad ligament or parovarian cyst is of slow growth, it is not tense like the usual ovarian cyst, it is a single cyst, and is as a rule cured by tapping. It contains a fluid like clear water, the specific gravity of which varies from 1003-1006. There is no deposit in the fluid, and few, if any, cells are found on microscopic examination.

Ascites, unless in very large amount, cannot be easily mistaken for an ovarian tumour; percussion gives a clear note in front, and a dull one in both flanks, and this is not likely to be the case with an ovarian tumour. If the position of the patient be changed, so will be the sound elicited by percussion. The history ought also to put one on one's guard. In very great enlargements, when the quantity of fluid is so great that the intestine cannot reach near enough to the wall to give a clear note on percussion, the chief point of diagnosis will be afforded

by the difference in respiration. In ascites the difficulty in breathing is very marked, and this is much more so than when there is a large ovarian tumour.

Encysted dropsy of the peritoneum, like fibro-cystic tumours of the uterus, is not common ; the history will probably reveal a previous attack of inflammation, the fluid increases slowly, the sac wall appears to be thin, intestine is found close to the fluid in every direction, and percussion along the pelvic brim often shows that the swelling does not possess any pelvic connection, a clear note being obtained completely across the lower part of the abdomen. The same clear note above the pubes and across the abdomen may occasionally be noted in ovarian growths. A patient fifty years of age presented herself at the Royal Edinburgh Infirmary complaining of an abdominal enlargement. On examination a collection of fluid was found having all the characteristics of an encysted dropsy. There was no pelvic connection to be made out, and a tympanitic note stretched across the abdomen a couple of inches in depth. The case was not an urgent one. When the patient returned, the band of clear sound had disappeared, and it was then evident that the swelling was an ovarian tumour, as it turned out to be.

Intestine adherent in front of an ovarian tumour might also confuse the diagnosis ; but in any such cases we have seen, the symptoms of ovarian tumour could not be mistaken.

A cystic tumour of the kidney may be mistaken for an ovarian tumour. The chief points of difference when the cyst is not large enough to entirely fill the abdomen are the position of the cyst in the loin, the want of pelvic attachments, a clear note on percussion across the lower part of the abdomen below the cyst, and the presence of the ascending or descending colon running across the front of the tumour. Mistakes are more likely to occur when the cyst is very large, and when no definite history can be obtained of the origin of the swelling. The cyst may be felt in the pelvis, and there may be an absence of clear sound across the lower part of the abdomen; but the position of

the colon, and the less amount of emaciation of the upper part of the body as compared with the lower limbs of the patient, will be the most reliable diagnostic signs in such large tumours.

Cysts of the mesentery, of the pancreas, and retro-peritoneal growths, have been occasionally mistaken for tumours of the ovary, and when they are large such a mistake is very easily made. When the growth is small, the position will usually exclude the possibility of ovarian disease, and such need not be considered at present. Large cysts of the mesentery usually grow slowly, and when they are situated in or behind the mesentery near the brim of the pelvis, and have pushed the intestines completely to the sides, it is probable that the diagnosis of ovarian tumour will be made. It is difficult to see how this mistake can be avoided, unless it be by the difference in the effect produced on the general nutrition of the patient. Large cysts of the pancreas may also be difficult to diagnose unless they be aspirated; as the fluid is withdrawn some indication will be gained as to which part of the body the tumour has sprung from, and when there is also a history of swelling having begun at the upper part of the abdomen a correct diagnosis may be arrived at. Solid retro-peritoneal growths, especially if malignant, may resemble a cancerous ovarian tumour very closely, and in such cases there is no manifest point of difference, as the general nutrition becomes affected by the maligant disease whether the tumour be retro-peritoneal or ovarian.

An enormous cyst of the liver or gall-bladder may resemble an ovarian cyst so closely that the diagnosis can be made only by reference to the original position of the tumour, and to the want of emaciation of the chest. In smaller growths, the evident want of any connection with the pelvis shows that the tumour cannot be an ovarian one. A solid enlargement of the liver, especially when accompanied with ascites, has been diagnosed to be an ovarian tumour. The shape and position of the tumour ought to be sufficiently diagnostic; and when

ascitic fluid is present the symptoms will be those already described, combined with the presence of a hard solid tumour in the right side and continuous with the liver dulness.

A hypertrophied condition of the spleen may be so great that the tumour fills the larger part of the abdomen and extends into the pelvis. The diagnostic signs consist in the raising of the ribs on the left side; in the position of the growth being more in the left than in the right; in the presence of notches along the right side; and in the percussion note being absolutely dull where the tumour appears from beneath the ribs, and becoming less dull as the right and lower borders are approached.

A condition of the abdomen known by the name of phantom tumour may resemble a cyst of the ovary in a very marked degree. This peculiar condition is seen usually in young women, or in women about the menopause; it is a distension due to some abnormal nervous state, especially affecting the intestines and the diaphragm, and the appearance of the abdomen may resemble one distended by a unilocular or multilocular ovarian tumour. The diagnosis is simple, because a clear note is elicited on percussion all over the abdomen. It has sometimes happened that in spite of this diagnostic point a patient has been prepared for operation, and a correct diagnosis has not been made until the anæsthetic has been administered. As soon as the patient becomes unconscious the distension disappears, but it returns when the effects of the anæsthetic have passed away.

Diagnosis of Adhesions.—Although it is not possible to be always absolutely correct as to the amount of adhesion present, yet an attempt should be made to determine before operation the exact connections of an ovarian tumour. In the first place, the history is a great guide; when there has never been any attack of pain in the abdomen, either since the tumour was first noticed, or for some time previously, the assumption is that the tumour will not have formed any adventitious connections. Should the patient have been confined to bed for some days, or more especially

for some weeks, on account of abdominal pain, the assumption is equally strong that there will be adhesions, and the longer the inflammatory attack has lasted, and the more severe it has been, the more firm are these adhesions likely to be. The strongest and most difficult adhesions of all to deal with are those met with when there has been a tumour in the pelvis during pregnancy. When there is a history pointing to the presence of adhesions, difficulty with the bowels will make one suspect that they have become attached to the tumour. When the tumour is free in front and the patient takes a long breath, the tumour can be seen or felt to move independently of the parietal wall. Careful percussion also at the upper part as the patient inspires deeply may show that intestine moves down between the wall and the tumour. The peristaltic movement in a piece of bowel adherent in front can be seen, and the gut itself can be felt either as a rounded band or as a tympanitic coil. Should there be a little ascitic fluid it may clearly show the presence of partial parietal adhesions, by the possibility of its being pushed in front of some parts of the tumour, and not in front of others. Sometimes, however, there may be the most intimate adhesion to the intestine without a history of any inflammatory attack whatsoever. A young married woman was sent into the Edinburgh Infirmary in June 1885. For about six months previously a painless abdominal swelling had been noticed. There had never been any history of abdominal pain, nor had the patient been confined to bed on account of any trouble in that region or in the pelvis. Examination of the abdomen showed that the tumour was composed of a single cyst, which was freely movable in front. The cyst could be felt on vaginal examination high up in the pelvis, and the uterus was quite movable. On opening the abdomen the cyst was seen to move freely on respiration, it was emptied with the trocar, but on drawing the flaccid sac forwards, it was seen that intestine was apparently incorporated with the wall of the tumour on both sides and above. This intestine was so intimately incor-

porated with the tumour that it was not considered advisable to make any attempt at removal; the sac was therefore stitched to the abdominal wall, and within seven weeks a sinus two inches in length alone remained. This sinus closed within a twelvemonth.

When an ovarian tumour has grown between the layers of the broad ligament, the condition resembles very much that of adhesion; and the surface of the tumour has to be separated from the inner surface of the expanded broad ligament, almost as if it were a newly formed adhesion. In such cases the uterus is invariably drawn out of position, and is not infrequently entirely raised up into the abdomen, the cervix being felt above the pubes on one or other side. The uterus, when it can be reached, is not freely movable, and movement of the tumour affects it at once. When the tumour is small it pushes the uterus to the opposite side, and as it enlarges takes the womb up with it into the abdomen, and the uterus will then be felt on one or other side above Poupart's ligament. Should the tumour have burrowed very deeply into the pelvic tissues, and pushed its way behind the uterus, and into the opposite broad ligament, the position of the uterus, instead of being lateral, will be almost central.

A cystic tumour, especially in young unmarried women, will not infrequently cause a retroversion, and apparent fixation of the uterus in this abnormal position; there are no adhesions, but the organ is simply pushed over by the tight abdominal walls.

The advantages to be derived from attempting to make a diagnosis of the exact condition, and the difficulties to be met with, will often save trouble at the time of operation, for one will then be prepared for difficulties in certain cases, and time will not be lost in considering what is the best thing to do. In addition to this, habits of precision are gained, and one becomes able to give a more correct prognosis than would otherwise be possible.

Dermoid Tumours.

A dermoid ovarian tumour is one in which fatty matter, hair, skin, bone, are one or all found. Such tumours are of slow growth, and do not usually attain to any great size ; one of 28 lbs. being the largest we have met with. They are often somewhat tender to the touch, and their presence may be suspected when the tumour is very hard. A positive diagnosis can be made when a piece of bone is felt. Their importance is due principally to the contents, and when entirely filled with hair their extraction, except through a long incision, is difficult. They are more liable to inflame than ordinary ovarian cysts, and adhesions are consequently found in a larger proportion of the cases. They are not very common, occurring once in about ten or fifteen cases.

Rotation of an Ovarian Tumour.

Sometimes an ovarian tumour rotates and causes a twisting of the pedicle. No satisfactory reason has been given for this accident, and when slight it does not give rise to any symptoms. When the twisting is sufficient to cause strangulation, the effect both on the patient and on the tumour is well marked. There is a sudden attack of severe pain in the abdomen, accompanied by general symptoms of prostration, and in some cases by a rise in the temperature and in the pulse rate. When this acute attack is over, the tumour often ceases to grow, or increases extremely slowly. When the attack is very acute, showing probably that the twisting has been sudden, and that the veins in the pedicle have become closed partly or entirely, there may be profuse hæmorrhage into the tumour, and the growth will be then found to have become suddenly enlarged. At times the pedicle becomes entirely twisted off, and the tumour is kept alive by the blood supply brought in through adhesions; these are not necessarily very extensive, and are commonly to the

omentum. The tumour itself becomes altered in appearance, it loses its white shiny colour, becoming dull and of a brownish hue. The lining surface shows no trace of blood vessels, and has sometimes almost a gangrenous appearance. This appearance of gangrene will be more marked if the tumour be removed when the acute symptoms are present, but, though tumours are sometimes reported as being gangrenous, there do not seem to be any cases on record where the tumour did actually become gangrenous as the result of twisting of the pedicle, though it may become so from simple inflammatory action. An acute attack of this nature may be followed by inflammation, and this may run on to suppuration.

The lessened amount of the blood supply explains the slow growth of those tumours, and a certain number do not fill up after a tapping.

In March 1883, an ovarian tumour was removed from a young woman twenty-four years of age, who gave the following history. Five years before she first noticed that her abdomen was enlarging, and soon afterwards she was confined to bed for two weeks with severe pain, accompanied by slight fever. After this illness the tumour grew very slowly, and there had been several similar, but not such severe attacks of pain in the abdomen. The tumour was fairly movable, but adhesion on the right side was diagnosed. At the operation the omentum was found to be adherent, and there was not any pedicle. The sac and contents weighed 8½ lbs., and on examination the twisted-up remains of the pedicle were seen. The inner lining of the cyst was of a dark grey colour, and showed no signs of vascularity.

In October 1888, a lady thirty-two years of age was seen in consultation with her usual medical attendant, who had been called in on account of a severe attack of abdominal pain without fever, but accompanied by collapse and symptoms of hæmorrhage. Some time before, he had diagnosed the presence of an ovarian tumour. The acute attack passed off, and when she was seen the diagnosis was confirmed, the attack of pain having been evidently

due to a twisting of the pedicle. Ovariotomy was advised, but the patient and her husband insisted on having a preliminary aspiration. This was done, and forty-eight ounces of bloody fluid were removed. A flaccid cyst could then be distinctly felt. The cyst has not refilled, and the patient has been perfectly well since the fluid was removed.

Rupture.

An ovarian tumour may rupture either from gradual thinning of the wall at one spot due to pressure from within, or to injury from without, or there may not be any apparent cause.

This accident is most common in papillomatous tumours, and the leakage may be either slow or sudden. A blow on the abdomen may cause rupture, or it may result from a rough examination. The amount of general disturbance which may follow a rupture will depend chiefly on the kind of fluid effused, and the rapidity with which it flows into the peritoneal cavity. When the fluid is non-irritating there will not be any disturbance, indeed the patient may not know when the rupture occurred. If the fluid be not of this simple character, there will be a more or less severe attack of general peritonitis.

The opening, instead of leading into the peritoneal cavity, may be into the bowel, vagina, or bladder, but a rupture in any of these directions only occurs when there are adhesions. This is more apt to happen in dermoid tumours, perhaps because they are adherent in a large proportion of cases.

A patient twenty-six years of age was admitted into the Edinburgh Infirmary in 1886, on account of an abdominal enlargement, which had been noticed for seven months. There was no history of pain or discomfort at any time. The examination showed that there was a quantity of free fluid in the peritoneal cavity, the presence of which could only be accounted for by the rupture of an ovarian tumour. An opening the size of a sixpence was found in the sac wall.

A thin delicate woman of twenty-four was admitted into the Edinburgh Infirmary in 1884. A cystic enlargement of the ovary had been discovered nearly two years before. On examination the tumour was found to extend half way up to the umbilicus, and was completely covered by adherent intestine. In the pelvis the cervix was felt to be much swollen, and all of the pelvic contents were firmly matted together. The history pointed clearly to a rupture having occurred into the bowel. As the tumour was not causing any trouble, the patient was advised to wait for a time in the expectation that removal would be more easy when the growth had increased in size, and that the general health might improve in the meantime. Some time afterwards the cyst ruptured into the vagina, and when the patient was next seen an opening was discovered in front of the cervix. As the discharge had become intensely offensive, the opening was dilated, and a large drainage tube was left in, after the interior of the cyst had been thoroughly washed out. This was followed by a great improvement in the general health, and the discharge became much lessened in quantity after a great number of long black hairs had been thrown off.

Suppuration.

Suppuration in an ovarian tumour is an accident which may follow a badly performed tapping, a simple chill, or a twisting of the pedicle. The inflammation in the cyst is not unlikely to spread to the general peritoneum, and the result of this is that ovarian cysts in this condition are almost invariably adherent. These adventitious connections are often universal and of great firmness.

The diagnosis is to be made by the history of the patient. After being well up to a certain time there is a sudden failure in health, following on one of the above-mentioned causes. A definite starting point may not always be discovered; the patient complains of rigors, or at least of a feeling of chill,

usually in the back; the pulse becomes quickened, the temperature may be subnormal, or perhaps raised half a degree or so, and there may not be any rise in the afternoon or at night; there is sweating, and the skin has a sodden appearance, with a peculiar acrid smell. The appearance of the patient is also very distinctive of suppuration.

A patient twenty-four years of age was operated on in June 1887 for a suppurating ovarian tumour. Since her third baby was born sixteen months before, the abdomen had not been quite flat. Her fourth child was brought into the world one year after the third. In the previous four months the abdomen was tapped twice, the fluid being described as of a yellow colour. The patient looked ill, and said she felt chilly, the pulse was 130, temperature 99°, the skin was sodden, and she sweated profusely. On examining the abdomen a partially filled cyst was felt, and the abdominal wall was hard and solid. The diagnosis was made of a universally adherent suppurating cyst. Rest in bed for a month brought the pulse down to 90, the temperature during that time varying from 97·8° to 99·2°. On making the incision the peritoneum was seen to be hard, cartilaginous, and fully one-third of an inch in thickness, and it was so incorporated with the cyst wall that an attempt was not made to effect its separation. The pus and lymph were removed, the sac washed out, dried and sponged over with chloride of zinc (forty grains to the ounce), a rubber tube was put in reaching to the pelvis, and a second over a foot long in the direction of the ribs. The patient went home in six weeks with a narrow sinus three inches in length, and had another baby within fifteen months.

Malignant Tumours.

For practical purposes malignant disease of the ovary may be divided into cases where there is and where there is not any cystic enlargement.

When the disease is found in the interior of an unruptured

cyst after ovariotomy has been performed, permanent recovery may result, but in a great majority of cases there will be at some future time a return of the disease in the abdominal cavity.

When the disease consists of a solid enlargement of one or both ovaries it is usually accompanied by ascitic fluid, and the treatment of this condition, and also of that when a cystic tumour with malignant contents has ruptured, has been considered when dealing with the examination of peritoneal fluids. A malignant tumour of the ovary more frequently opens up the broad ligament than a simple one.

Some of the rapidly-growing, thin-walled tumours with viscid jelly-like contents, are closely allied to malignant growths.

Prognosis.—A patient with an ovarian tumour can only look forward to a few years, usually to but a few months, of unutterable misery, unless the disease can be removed. What then are the chances of recovery we can offer when we tell a woman that she has one of these tumours? Naturally she will wish to know. The prognosis to be given now compared with that of twenty-five years ago is very different. Then, the patients applied late for operation, after they had often gone through several attacks of peritonitis, and only when the general health was much deteriorated. At that time no one with the exception of Dr. Keith could offer a mortality of under 20 per cent. Now, this is quite changed, and any woman who is fairly strong and healthy need not run a greater risk than at the outside 5 per cent. Before giving a prognosis it is necessary to have a good general idea of the condition inside the abdomen; the presence or absence of adhesions, in what part of the abdomen they are, their probable consistency, and the condition of the tumour, suppurating or otherwise. If we know that the tumour is not adherent, we can then give the comforting assurance that the risk of the operation is practically nothing, and that all that has to be feared is the accidental risk present in all operations of one, or at the outside two, per cent. If the tumour be badly

adherent, or if the broad ligament be extensively opened up, we must allow for some risk in the operation itself—say 5 per cent. The amount of risk entailed by the presence of adhesions varies chiefly with their extent and position. Pelvic adhesions do not add much to the danger of the operation; but when the adhesions are in the upper part of the abdomen or to the mesentery, especially when the tumour is very large so that their extent is great, there is a certain amount of risk from shock, due to injury or irritation of the sympathetic nervous filaments, which must be taken into consideration.

The prognosis will differ also in another class of cases, viz. that of the delicate women; some of whom, when the heart is weak or where there is fatty degeneration, bear operations extremely badly, and the removal of a perfectly simple non-adherent tumour may result in death within forty or fifty hours from shock.

A lady forty-two years of age was operated on in May 1885 for ovarian disease. A simple non-adherent tumour was removed, and when the patient was put back to bed the pulse was 120, soft and weak. Flatus passed, the abdomen was perfectly flat; but in spite of the favourable progress at the seat of the injury the pulse steadily increased, while the heart's action became weak, and the patient died before the end of the second day. At the *post mortem* examination nothing was found to account for death except the presence of a heart which had undergone a considerable amount of fatty degeneration.

When there is the combination of a delicate woman or of one with the general health thoroughly broken down by suffering and a badly adherent tumour, it is reasonable to suppose that there will be a greater risk than if one of these factors alone were present.

The prognosis in the case of suppurating ovarian tumours is very favourable.

The operation of ovariotomy is now so successful that several surgeons have had more than fifty cases of recovery

without a death intervening. Dr. Keith was the first to have one of these series, having eighty consecutive recoveries more than ten years ago. A much larger list has been published, but other than cases of ovarian tumour were included in this series.

When the patient asks when should the operation be performed, the answer must be the sooner the better, for the longer the tumour remains in the abdomen the more likelihood there is that the operation will be complicated, and at any moment an attack of peritonitis may begin. The patient must not wait until the health is broken down.

During the course of an acute disease operation is out of the question, and in the far advanced cases of phthisis and of malignant disease the patient must be content with palliative measures.

Ovarian Tumours with Pregnancy.

When an ovarian tumour is discovered during the course of a pregnancy, the treatment to be adopted will depend on the stage at which the pregnancy has advanced, and on the presence or absence of pelvic adhesions. The operation does not of necessity cause abortion when one ovary has been removed, and it is even possible to go on to full time after the removal of both. In the early months, removal of the tumour ought always to be advised without any hesitation, unless there be much adhesion in the pelvis, and consequently in all probability to the uterus. Adventitious connections to the pregnant uterus are certain to be exceptionally vascular, and this condition would not only have to be combated, but a considerable risk of injuring the softened uterus would be incurred. Under the circumstance of pelvic adhesion, if the tumour be growing slowly, it will be possible to carry the patient on to full time either by doing nothing, or by one or more aspirations if the tumour be composed of one or several large cysts. When the tumour is of such a nature that its bulk cannot be reduced by aspiration, it is probable that its growth will not be rapid, and it can therefore

be left alone. In the exceptional circumstance of a solid tumour growing rapidly, the growth must be removed; or if it appear to be certain that much separation of adhesions in the pelvis will have to be done, the preferable course will probably be to induce abortion and operate six weeks or two months afterwards. When a small ovarian tumour is found to be fixed in the pelvis, where it must inevitably cause obstruction to the birth of the child, it ought to be removed immediately, for if it be left alone there will be in the first place great difficulty during the labour, and if the mother survive the birth, the pressure which has been exerted by the passage of the child on the growth will result in the formation of most intimate adhesions, which will complicate in a marked degree the future removal of the tumour. In the later months of pregnancy an ovarian tumour ought to be left alone until after the birth of the child, and it would only be advisable to remove it in the presence of exceptional circumstances. Unless there be any special reason for operating before the birth, nothing is to be gained by doing so, and a very considerable risk is run of bringing on premature labour. In a recent number of the *British Medical Journal* two cases were reported, one in this country and one abroad, where ovariotomy was performed apparently without any special reason at the seventh and eighth months of pregnancy, and in both of these cases premature labour was the result.

In 1885, a woman was operated on in the Royal Infirmary, Edinburgh, for ovarian disease. The patient knew that she was about three months pregnant, and sought advice on account of the unnatural size of the abdomen. A cystic tumour was found, nearly the size of an adult head, freely movable, and as there was no history leading one to expect the presence of adhesions, the tumour was removed. The patient made an uninterrupted recovery, and a year after the birth of the child it was found that the scar had not stretched in the very slightest degree.

To sum up shortly what is to be done with an ovarian tumour when the patient is pregnant, it may be said that before the fourth month, when adhesions are not suspected, the tumour ought to be removed; if there be adhesions it is best to temporise, aspirating the fluid if necessary, unless the growth be adherent in the pelvis. When so adherent it will be best to empty the uterus. After the fourth month no more serious operation than removal of the fluid ought to be resorted to.

CHAPTER II.

OVARIOTOMY.

Historical.

The removal of a tumour of the ovary has been called by the name of ovariotomy. As the history of the operation in its early days is also the history of abdominal surgery, it is interesting and instructive to look back to the early operators and their methods, and to trace the various changes which have taken place in the treatment of these growths. In the comparatively short space of eighty years methods have been tried, have been found wanting, and, in some cases, have again come into practice, either to be again discarded, or to be adopted with perhaps some modification, which renders them useful or convenient.

To Ephraim M'Dowell of Danville (Ky.) undoubtedly belongs the credit of having first deliberately performed the operation of ovariotomy in 1809, and of thus being the illustrious founder of the whole practice of abdominal surgery; a practice which now embraces operations on every organ in the abdomen. It is also almost as certain that he was the first to remove an ovarian tumour from a living woman. The honour, however, has been claimed both for Houstoun of Scotland and for L'Aummonier of France. From the description given of Houstoun's case it appears that he made a free opening into an ovarian tumour filled with colloid material, the cyst wall was adherent to the peritoneum in front, and the thick gelatinous contents were drawn out by the help of a fir branch. The cyst was drained

by placing lint in the wound to keep it open, and the result was that recovery took place then, as it may do now. For example, in the year 1885, a lady seventy-five years of age was seen with a large abdominal tumour; a diagnosis of a single ovarian cyst adherent in front and partly covered by intestines was made. As the lady was old and feeble, it was advised that the cyst should be drained, unless the adhesions were found to be less firm than was expected. In addition to their being very firm they were exceedingly vascular, so the contents which were gelatinous were emptied, a couple of drainage tubes were put into the sac and the wound was left freely open. Within six weeks the sac, which had contained over twenty pints of fluid, had contracted down to a sinus five or six inches in length, and without the occurrence of suppuration.

L'Aummonier's case in 1776 appears to have been one of a collection of pus in a Fallopian tube. The ovary was removed without any apparent reason, and the tube or abscess cavity was opened and drained. This patient also recovered. There is nothing doubtful about M'Dowell's operations. While a student in Edinburgh, M'Dowell undoubtedly obtained the idea of the possibility of removing an ovarian tumour from Dr. John Bell, and after his third operation he sent the account of his cases to his former teacher. Dr. Bell was, however, ill in Rome, and the description of the operations seems to have been retained by Lizars, who was at that time doing Dr. Bell's work.

It is not necessary to mention all the names connected with ovariotomy in its early days, and reference will be made only to those who threw special light on the operation.

Dr. M'Dowell made a long incision, not in the middle line but along the outer border of the rectus muscle. In his first case he had to reduce the size of the tumour before he could bring it outside, and one is inclined to wonder why he continued to make unnecessarily long incisions. The pedicle was tied with cord, the ends were left long and were brought outside through the wound. This was a correct practice to adopt at the time,

for it was supposed that the distal part of the pedicle must slough, and that an open path must therefore be left for its exit. Sometimes the pedicle sloughed and sometimes it did not, and looking back it is easy to see how this happened. We now know that the distal portion need not die, but in the old days a septic or dirty piece of cord was used to constrict this piece of tissue. The part beyond the ligature had its vitality lowered, and, if the septic poison in the ligature were strong, this injured part naturally succumbed and had to be thrown off. If, on the other hand, the natural vitality of the tissues was great, or if the ligature was cleaner than usual, the tissue did not die, and the ligatures were drawn away with difficulty. As M'Dowell used these septic ligatures, his practice of leaving them long was perfectly correct with the knowledge he then possessed.

Twelve years after M'Dowell's first operation, Dr. Nathan Smith removed an ovarian tumour composed of a thin-walled single cyst. He had not heard of any previous operation, and it is interesting to see how different his methods were as he had no traditions to follow. He made an incision three inches in length through the middle line, and instead of tying the pedicle *en masse*, he ligatured two vessels in it with a strip cut from a kid glove. The abdomen was then completely closed. The patient recovered. Here there was already an improvement; the incision had been made shorter, and the pedicle had been allowed to drop back into the abdomen. It may be considered doubtful whether this was at the time good practice; but the attempt was made to use an animal substance for the ligature, with the idea doubtless that it would not cause suppuration.

The third American surgeon who was successful in removing an ovarian tumour was Dr. Alban Smith of Danville. Again there were new departures, for, though he followed Dr. M'Dowell in so far as to use the long ligatures, he carefully included the peritoneum in his sutures, and administered on the night after the operation a dose of senna, which caused the bowels to act next day.

Fifteen years after the first operation of ovariotomy, Lizars of Edinburgh was induced, doubtless by the perusal of the account of the three first cases sent to John Bell, to operate on a case of supposed ovarian disease. An incision was made from the sternum to the pubes, and every spectator put his hand into the abdomen to satisfy himself that a tumour was not present. The patient recovered! At his second operation, Mr. Lizars met with a case of double ovarian disease; he removed one of the tumours, but failed to take away the other. This patient also recovered and lived for a number of years.

In 1837, Mr. Jeafferson of Framlingham successfully removed a single cyst. He was acquainted with the details of Dr. Nathan Smith's case, and following his example did not use the long ligatures, but allowed the pedicle to drop back. The incision also was short, being described as one inch in length.

A pupil of Lizars, Dr. Charles Clay of Manchester, operated in 1842, and had three successful cases out of his first four operations. He used the long ligatures.

Dr. Washington Atlee and Dr. Peaslee were amongst the early operators; the former began in 1844, the latter in 1850, and both these surgeons assisted greatly in establishing the operation in America.

In 1853, Baker Brown began to operate. Not being satisfied with the results obtained by the use of the long ligatures, and being unable to understand why it was that cases did badly when the pedicle was ligatured and allowed to drop back into the abdomen, he came to the conclusion that the fault lay with the ligature itself, and that it must be got rid of. He therefore closed the blood vessels in the pedicle by means of the actual cautery. This was a great step in advance, because it allowed of the intra-peritoneal treatment of the pedicle, and at the same time did not leave a septic ligature in the abdominal cavity. This plan of treatment is undoubtedly the most perfect method, but it has not been generally adopted, simply because we do not now use the septic or dirty ligature of forty years ago.

In 1858, Spencer Wells performed his first operation in London, and it was a success. The long ligatures were used. In his third case, however, he fixed the pedicle outside the abdomen by means of a clamp, as it was evident that if suppuration were to take place, it would be better that it should do so outside rather than inside the peritoneal cavity. Here also there was a great advance over the usual practice, and one reason why the clamp failed to get such good results thirty years ago as can be obtained now, is that knowledge was wanting to teach the necessity of preventing the tissues about the clamp from becoming putrid or septic. There are minor objections to its use, but the great fault was not so much in the instrument itself as in the way it was used, for, if sufficient care be taken to dry the tissues and mummify them so that they do not give rise to septic discharge, the mortality will not be much, if any greater than when the intra-peritoneal method is used. The length of his incision was regulated according to circumstances, a large solid tumour requiring a long incision, a small thin-walled cyst a short one. It is an unfortunate sign of the times that some are nowadays inclined to minimise the work done by Wells in the early days, when they themselves were children. This should not be, for a great work was done; he assisted very largely in convincing a sceptical medical profession that the operation of ovariotomy was not only a justifiable one, but also a work of necessity, and this operation is now so successful that it is difficult to understand how there ever could have been any doubt as to the propriety of the procedure.

To Koeberlee, who commenced to operate in 1862, we owe the catch forceps, and the idea of draining the abdominal cavity by means of a glass drainage tube.

In 1862, Dr. Thomas Keith performed the second successful ovariotomy in Scotland, the first having been done a few days before by Mr. Baker Brown in Aberdeen. After his first case he advocated the thorough cleansing of the peritoneum, and

after a visit to Koeberlee he devised the method of draining from the bottom of the pelvis.

It is impossible at the present day to realise what the operation was thirty years ago; very little was known about it, and when operative measures were denounced on all hands, it is not to be wondered that patients did not apply for relief until they could go on no longer.

The one great and prominent idea seems to have been "do not injure the peritoneum, anything but that."

Gradually the plan of ligaturing the pedicle has come into use, and with it the intra-peritoneal method, which is undoubtedly the correct way; and now, as the outcome of Lister's teaching, we leave silk ligatures in the abdominal cavity with impunity, always provided that these ligatures have been rendered clean, either by boiling or by soaking in an antiseptic solution. The difficulty was to get a ligature which would not do harm, and for a number of years Dr. Keith used fine, soft iron wire with the best results. Indeed by the help of the cautery, the soft iron wire ligature, and drainage, he had reduced his mortality to less than 4 *per cent.*, and this was more than fifteen years ago,—an amount of success which was not even approached by any one at that time.

With improved practice and better results, it was impossible to allow patients to go on so long as before without advising operation, and the first to practise this was Baker Brown. The propriety of advising patients to wait as long as they could is easy to understand when operation meant a mortality of 30 or 40 *per cent.* It is quite a different thing when the mortality is less than 5 *per cent.* One reason for this diminished mortality is that the operations are now in the great majority of cases more simple than they used to be. Dr. Peaslee shows this very well in his book written in 1872, when he says tumours of "40 or 50 lbs. are so common as scarcely to deserve mention." Even so late as 1882, five consecutive operations were performed in the Edinburgh Royal Infirmary, where

the average weight was 44 lbs., though one tumour weighed only 8 lbs.

At the present day it is a great mistake to wait until the general health begins to break down, but at the same time it is not right to be in too great a hurry even with an ordinary case. The rule should be to perform the operation as soon as possible, but it is not right to tell the patient that it is a matter of life or death to have it done within a day or two. It is often not convenient for a woman to have a serious operation performed at a day's notice, and a delay of some weeks will as a general rule do no harm. At the same time it must not be forgotten that danger may arise from delay, and that therefore unnecessary putting off must not be allowed.

What has brought abdominal surgery within the range of many with a fair prospect of success is the teaching of Lister or the outcome of that teaching. Before his time every operator was more or less septic. Dr. Keith was indeed as careful of cleanliness then as now, with the result that his mortality was much less than that of any other operator; but to be rigidly clean was not a good surgical "cry," and it was necessary to be aseptic. Not ten years ago, this was once brought very forcibly to mind by hearing a gentleman who was going to assist at an abdominal operation say, when asked to wash his hands, "I did it this morning." He was quite willing to wash them in carbolic lotion however!

To recapitulate the great advances, we have in order of time, first, the short instead of the sternum to pubes incision; second, the clamp rather than the long ligatures; third, the toilet of the peritoneum; fourth, drainage; fifth, the cautery and intra-peritoneal method rather than the clamp and extra-peritoneal method; sixth, early operation; and seventh, Listerism and its outcome of perfect cleanliness.

Treatment of Ovarian Tumours.

The withdrawal of the fluid from an ovarian tumour used to be a common mode of practice, and in some of the out of the way country districts is still much resorted to. Not twelve years ago, a patient who was admitted into the Edinburgh Royal Infirmary with an ovarian tumour gave as her reason for coming early that a neighbour had been tapped until she died, and that she herself wished to try something else!

Aspiration of an ovarian tumour without a distinct object in view is to be condemned. It may, however, be used under the following conditions :—

When the general health has become broken down on account of the great size of the tumour, temporary relief may be given by removing the fluid, and this will allow of some improvement in the general health before the operation of ovariotomy is performed. This relief is obtained either by taking off pressure from the chest or from the kidneys, and at the same time anasarca of the lower limbs and abdominal wall will be reduced.

For the same purpose a smaller cyst might have to be emptied if the fluid had become purulent, the major operation being performed in about ten days, when the patient had improved as much as she would be likely to do.

In the course of some acute disease such as bronchitis great benefit may be obtained by aspiration, and the patient may thus be tided over such a complication.

In the later months of pregnancy the reduction in size of an ovarian cyst will allow the patient to go on to full time with comfort.

It may happen that a patient is unable to undergo the operation of ovariotomy for private reasons, and aspiration may allow her to carry on until her affairs are settled, and she could have the operation performed.

Ascitic fluid surrounding a tumour, when there is any

suspicion of malignant disease, must be removed for microscopic examination, or a cyst may be aspirated to clear up a doubtful diagnosis.

It may again be repeated that a cyst must never be emptied except with the aspirator, and that ascitic fluid is always to be removed by tapping. For diagnostic purposes a syringeful of fluid is sometimes withdrawn from a cyst. A more dangerous practice has never been adopted, for it simply means that a great risk of rupture is incurred while very little information is obtained, as a large quantity of fluid is required to get the deposit necessary for a satisfactory microscopic examination. Whenever a needle is put into a cyst all the fluid must be withdrawn, and, as thick fluid may be met with, a powerful aspirator is necessary. It is impossible to make a diagnosis of an ovarian tumour from the examination of the fluid alone; it can only assist, and it is a practice that need seldom be resorted to.

The following cases are typical examples of the advantages of aspiration under certain circumstances:—

In 1880, a patient thirty-three years of age was admitted into the Edinburgh Royal Infirmary with an enormously distended abdomen. The patient stated that four months before she had been quite flat, and the rapid accumulation of the fluid probably accounted for her very weak condition. The pulse was small, weak, and was beating 125 to the minute. She had rapidly fallen away chiefly in the upper part of the body, but also in the lower limbs; and, as the examination of the abdomen made one suspect the presence of extensive parietal adhesions, it was thought that her chances of recovery would be increased by a preliminary aspiration. This was accordingly done, 62 lbs. by weight of fluid being removed. Next day the pulse had fallen to 100, and when the tumour was removed ten days afterwards it was under 90. The amount of adhesion was fully more than was expected, but the patient recovered without a bad symptom.

In 1889, a young lady twenty years of age was sent from the country with a large suppurating ovarian cyst. The condition of the patient was extremely bad, she was terribly emaciated, became faint on making any little exertion, and the pulse the day after the journey was 140. Sixteen pints of putrid pus were removed from the cyst with enormous benefit; the pulse fell rapidly, the temperature became normal, sweating stopped, and nine days afterwards, when the operation was performed, the patient was in fairly good condition. It was fortunate that the general health had been improved, for the tumour was intimately adherent, in front to the parietes, above and behind to intestine, and below in the pelvis. It is at least probable that recovery would not have resulted if the preliminary aspiration had not been performed.

In 1885, a patient forty-two years of age was seen late one night with an enormously distended abdomen. The legs were fully twice their natural size, and the abdominal wall was greatly thickened by œdema, the face was puffy, and the patient could not lie down in bed. For about a week she said she had been passing very little water, and in fourteen hours only three and a half ounces were obtained. On boiling and adding nitric acid albumen deposited to nearly two-thirds. The fluid was drawn off from the abdomen by a trocar four inches in length inserted some way above the umbilicus, and it had to be pushed in its whole length before the peritoneum was reached. Nearly 70 lbs. of fluid were removed, revealing a flaccid ovarian tumour, and as the abdomen began to fill up rapidly as the œdematous swelling of the legs and wall went down, ovariotomy was performed at the end of a week. The urine was then free from albumen. The patient made a good recovery.

After the removal of fluid for any of those causes, the exact day for the major operation will depend on the condition of the patient. It can seldom be postponed beyond a fortnight, and it should be performed whenever the patient has improved as much as it is expected she will do. If this time be allowed to pass

it will be found that even two or three days' delay will make a considerable difference in the strength of the patient.

It is not often that one meets with a patient who absolutely declines to have the operation of ovariotomy performed simply because her business prevents her lying up for the necessary three or four weeks, but in 1890 such a patient was met with. When first seen two years before, the tumour extended half way up to the umbilicus, and a diagnosis had been made by two hospital physicians of fibroid enlargement of the uterus. The patient was told that the tumour was not uterine but ovarian, but as it was small, and giving rise to no trouble, an operation was not insisted on. Twice within the following year the patient was examined, little difference being found in the size of the growth, and the general health remained good. In the next six months the tumour had increased so much that it filled the whole abdomen, and raised the ribs on both sides; the patient now presented the typical appearance caused by an ovarian tumour, she having become much emaciated in the upper part of the body. She positively declined to submit to ovariotomy because she was too busy, and aspiration had to be resorted to. A few months afterwards the tumour was removed.

The slight operation of removing fluid from an ovarian cyst by aspiration is absolutely safe when properly carried out. The essential precautions to be adopted are,—a clean instrument of small calibre, a clean skin, complete emptying of the fluid, puncture opening at the highest level, and absolute rest in bed for three or four days. The usual mistakes which are made are,—too large an instrument is used, the fluid is not completely emptied, the puncture opening is not made at the highest level, and absolute rest in bed is not insisted on. In addition, the patient is not protected from catching cold when the large quantity of warm fluid is being removed.

The operation of ovariotomy having been decided on, the patient is got ready in the way already described, by the administration of a dose of castor-oil, and light food the day before.

This amount of preparation is amply sufficient for the great majority of cases. Should there be any intercurrent disease, such as an attack of acute bronchitis, or any of the conditions

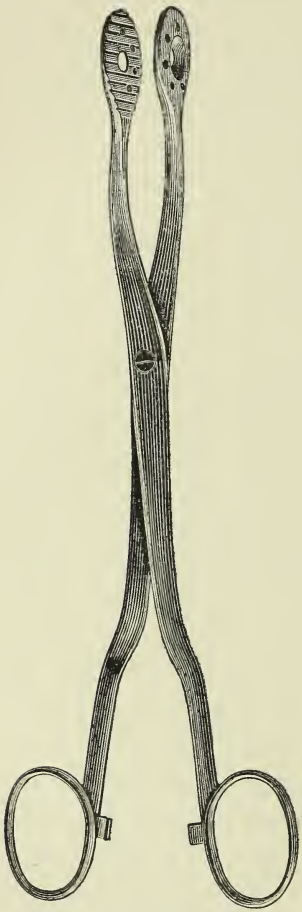

Fig. 23.—Nelaton's Forceps.
(One-third size.)

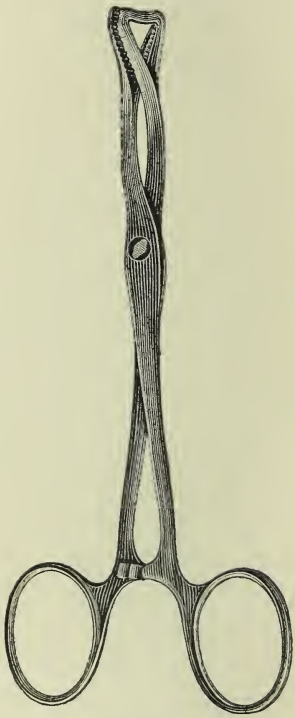

Fig. 24.—Cyst Forceps.
(One-third size.)

already mentioned, it must be attended to before the operation ; but these can hardly be included under the ordinary preparations of a patient. Three or four weeks' preparation by laxatives, tonics, feeding up, vapour baths, etc., is quite unnecessary ; it is

likely to alarm the patient and make her think that something dreadful is going to happen.

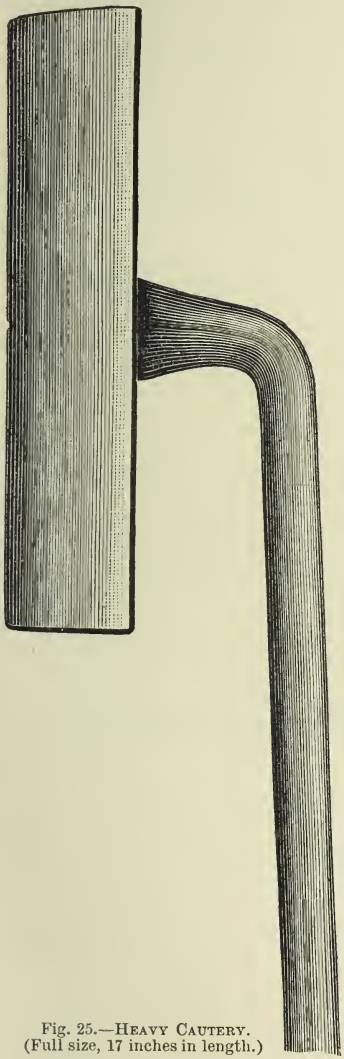

Fig. 25.—Heavy Cautery.
(Full size, 17 inches in length.)

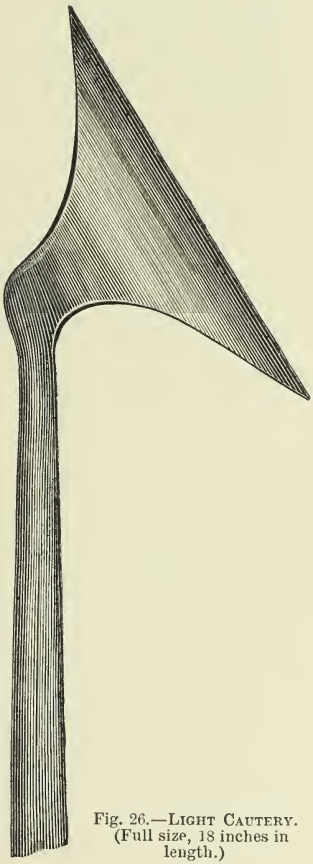

Fig. 26.—Light Cautery.
(Full size, 18 inches in length.)

A few special instruments are required for the operation.

Trocar and tube. Much ingenuity has been spent in attempting to improve on the old simple trocar. Various additions,

such as teeth for grasping the cyst, have been made, but it is more than doubtful if any of them are improvements.

An aspirator with a small trocar. The instrument known as Wells' tapping trocar is to be taken when pus is expected. When the aspirator is used there is less risk of rupture of the

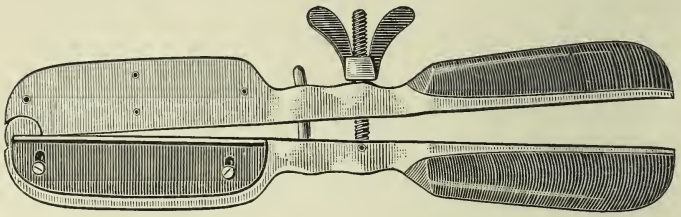

Fig. 27.—Cautery Clamp. (One-third size.)

sac and escape of fluid, and the pus is conducted away from all fear of contaminating instruments or sponges.

It should be remembered that there is usually no great advantage in any special make of forceps or other instrument, and the one will be best as a rule which the operator has become accustomed to use. Every one should be as simple as possible.

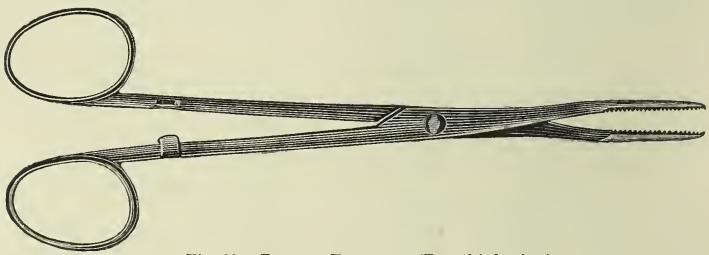

Fig. 28.—Pedicle Forceps. (Two-thirds size.)

Nelaton's forceps.

Cyst forceps are lighter and perhaps more convenient than Nelaton's.

Cautery clamp.

Cauteries, three are sufficient.

Forceps which prevent slipping of the pedicle after the cautery has been used.

Thermocautery.

The Incision.

The incision is to be made through the linea alba, not by the anatomist, but by the surgeon. A page or two might be written about the anatomical structure of the abdominal wall, but it is not necessary to spend five or ten minutes making a dissection, the object is to cut into the peritoneal cavity in as many seconds. It is futile to attempt to count the layers of the abdominal wall, as has been gravely suggested. If five minutes be taken to open the cavity, four and a half have been wasted on the least important part of the operation. It is sometimes recommended that the length of the incision should be at first two inches or so, and should be enlarged if necessary ; but when a proper and full diagnosis has been made, the necessary length of the incision is made at once. When the tumour is cystic, and is not composed of any semi-solid material, a cut of two or three inches is quite long enough; when the growth is semi-solid a longer incision is necessary. The length of incision which is first made is simply a matter of diagnosis. It is well to know, that although the peritoneum is usually a thin soft membrane, it may be sometimes half an inch or more in thickness; and, instead of being soft, may be as hard as cartilage. When the tumour will not come out through a comparatively short incision, and the opening has to be prolonged beyond the umbilicus, there is no reason why that part should be avoided, and the scar is firmer there than at any other part of the wound, but it must be accurately brought together with a number of stitches. The incision should stop at least one inch above the pubes, as this helps to prevent the bladder being injured.

The advantage of a very short incision is, that there is so little exposure of the peritoneal contents that the operation becomes almost a subcutaneous one. In regard to the question of a subsequent ventral hernia, it is at least open to doubt whether a very short incision is an advantage. Certainly one sees more of these herniæ now with short incisions than in the

wounds of ten or fifteen years ago, but this may be accounted for by want of care in stitching, and by the fact that many who have had no surgical training frequently perform abdominal operations. The intra-abdominal pressure acts at one weakened spot instead of being spread over a longer one, and this is probably a disadvantage. Whether the short incision conduces to the formation of a hernia or not, it does not alter the surgical principle that a free external incision is advisable; and manipulation should never be hampered, nor a tumour dragged through a wound with violence for the sake of an inch or two of cut abdominal wall.

When the peritoneum has been exposed it must always be opened at the upper angle of the wound.

Extraction of the Tumour.

The tumour having been exposed, it will be seen, if not adherent in front, to move freely with respiration; it is not necessary at this stage to pass the hand into the abdomen, indeed the more it is kept out of the peritoneal cavity the better. The trocar, to which is attached a rubber tube long enough to reach to a bath below the table, is plunged straight into the tumour at the most prominent point. This prevents oozing alongside of the trocar, as the tension on the cyst wall is at once relieved, and as the opening is at the highest level fluid cannot escape into the peritoneal cavity. The assistant takes charge of the trocar, and also of the tumour as it comes out, and this leaves the two hands of the operator free. As the fluid flows away, the cyst is caught above and below the trocar on the assistant's side by a pair of cyst forceps, and these are handed over to him. The object of this is to draw the tumour out of the abdomen and to prevent fluid leaking into the peritoneal cavity, as it might do if the tumour on the side of the operator were caught hold of, for the trocar opening would then be pushed round into the abdomen. As the tumour empties it is slowly

drawn forwards, and as it comes out the operator inserts a sponge into the abdomen to shut off the contents from the outside. The assistant supports the sac and prevents dragging on the pedicle, the treatment of which has now to be determined.

The Pedicle.

It is universally agreed that in all but very exceptional cases the pedicle must not be fixed outside the abdomen. At one time, with the knowledge of the day, the clamp was a useful instrument. It prevented the loss of blood by constricting the pedicle, it was fixed across the lower part of the wound and came away in from ten to fourteen days, leaving a small healing ulcer. Dr. Keith's mortality with his first fifty clamp cases was under 15 per cent., showing that it was not this method of treatment which was the cause of the heavy mortality of twenty-five years ago. This method of treating the pedicle is nowadays only required when there is a prolapse of the uterus in addition to the ovarian tumour; and both the disease and the displacement can be cured by the one operation, when the uterus is fixed to the abdominal wall by clamping the pedicle.

The closure of the blood vessels in the pedicle, when it is to be treated intra-peritoneally, is accomplished either by the ligature or by the cautery. Of these two methods the ligature has gained much greater popularity than the cautery. The reason is not far to seek, for the cautery not only requires a little more care and delicacy of manipulation than the ligature, but also some of that rare quality—faith—though strangely enough the pedicle never bleeds after the cautery, while a number of deaths have resulted from this cause after the use of the ligatures.

Ligature of the Pedicle.

When it is determined to tie the pedicle, a piece of chemically clean silk three feet in length is grasped in the middle by

the pair of sinus forceps. A spot near the centre of the pedicle where there are no blood vessels is selected, and the point of the forceps holding the silk is pushed through; the loop of silk is drawn out, divided, and the forceps withdrawn. Instead of the forceps, a Peaslee's or a round-pointed needle may be used. Each half of the pedicle is in turn constricted by one half of the divided ligature, and the loops are not allowed to interlock. Each half is tied as tightly as possible, a double twist being made on the first knot to prevent slipping, and the two double ends are tied tightly together, thus constricting the pedicle very securely. A second way of tying is to transfix, some preferring to do it with a needle rather than with the forceps, tie each half having interlocked the silks, and then surround the whole pedicle with a single ligature. The disadvantages of this way are that the knot of the first loop is drawn on when the second is tied, and the supplementary single ligature is useless as it lies in the groove already formed, and would not prevent hæmorrhage from a splitting downwards of the pedicle. Interlocking does not prevent this accident, which, however, is only likely to occur when the transfixing or tying has been roughly or carelessly performed. A third method is by the well-known Staffordshire knot; the silk can be arranged either by putting the loop round the pedicle, and carrying the free ends back to the loop by transfixing with Lister's forceps, one end passing above and one below it; or by taking the centre of the ligature through the pedicle, bringing the loop over the top, and passing one free end above while the other is below. The ends are then tied. The only disadvantage is, that the silk has to be rather thicker than when the other methods are employed, as the knot is tied over what is practically a rigid bar.

The tumour is then cut away, fully half an inch of pedicle being left beyond the ligatures.

The Cautery.

When the cautery is preferred to the ligature, the pedicle is enclosed in the cautery clamp, and the old instrument of Baker Brown is better than any of the more complicated ones. The blades of the clamp are tightly screwed together, and as the pedicle is allowed to take its natural shape, it does not become bunched together as is the case when the ligature is used. The tumour may be cut away, leaving half an inch or so beyond the clamp, or the separation may be effected by the cautery.

Towels which have been rendered aseptic are tucked in under the clamp to prevent burning of the skin, and the remainder of the pedicle is burnt off with one of the heavy cautery irons heated to a white heat, leaving a line or so of tissue beyond the clamp. The chief aim is to heat the clamp, and it is for this reason that large cauteries are required; an instrument like the Paquelin cautery gives out much too small a quantity of heat to do this quickly. The clamp should be so hot that the fingers can barely touch it; and if the pedicle be thick and fleshy a second heavy iron may be required to thoroughly heat it. It will be then found that the clamp can be screwed up a little tighter, and this must be done, as what is wanted is the result of the combination of heat and pressure. The charred portion of the pedicle is smoothed over with the sharper and lighter cautery. The clamp is to be quickly cooled with a wet sponge, a towel removed, and a pair of pedicle forceps fixed gently on to each side below the clamp to prevent it slipping, until it is certain that the blocking of the vessels is perfect. The clamp is unscrewed and the blades separated; this must be done carefully and gently, as the pedicle sometimes sticks to the blades of the clamp, and rough manipulation might easily cause bleeding. With ordinary care this need never happen. As the forceps prevent the pedicle slipping out of sight, that part which had been enclosed in the clamp will be seen to be almost translucent, like a thin piece of horn. Should the pressure or the

heat have been insufficient, one or more blood vessels will be seen making their way through the cauterised part. This may occasionally happen at first, but after a little practice it need never occur. The part where such a vessel appears can be easily ligatured.

As soon as it is seen that no blood vessels pass into the compressed part, the pedicle is allowed to drop back into the pelvis, and this can be done with a feeling of absolute safety. The great advantage lies in this, that should there be bleeding from the pedicle it occurs immediately, and not after the abdomen has been closed.

When much sponging is required, the pedicle is temporarily secured in the grasp of one or two large catch forceps, and the tumour is cut off and got out of the way; then, after the sponging is finished, the cautery can be applied to the pedicle, as it is not advisable to run the risk of ruffling it with much sponging.

The only advantage the ligature possesses over the cautery is in the question of time. A pedicle can be ligatured in about a minute; the cautery takes from two to three minutes. The ligatures have, however, several disadvantages; the knot may slip from imperfect tying; or one loop may slip over the end of the pedicle when the distal portion has been cut off too short, thus causing a want of proper proportion between the size of the silk loop and the amount of tissue beyond. The pedicle may also split downwards from the puncture opening, possibly from pressure of the knot of silk at that spot.

The following are examples of how hæmorrhage may occur after the pedicle has been tied. The first case was operated on by Dr. Keith, and is the only one where such an accident has happened either in his or in our practice. The patient thirty-one years of age was operated on in 1886. Two small ovarian tumours were removed, and in both the pedicle was thick and short. The cautery was applied to the one, the ligature to the other. After the ligature was applied, the end of an artery, the

size of a large radial, was noticed projecting from the cut surface; about half an inch on the other side of the ligature the peritoneum had been slightly injured when drawing up the short pedicle, and there was a very slight oozing at this point. Five hours after the operation the patient was very well, but four hours later the nurse noticed that she became suddenly very white, and she was dead before assistance could be obtained. An examination was made, it was found that a large hæmatocele had formed in the right broad ligament, and that the tension had drawn the artery previously mentioned through the ligatures. The hæmorrhage came from that vessel and discharged into the peritoneal cavity through the injured part of the broad ligament. The ligatures were apparently perfectly firm. No bleeding had occurred from the pedicle which had been cauterised.

A non-adherent ovarian tumour was removed from a patient twenty-seven years of age, the pedicle was tied with the Staffordshire knot. Within half an hour of the patient being put back to bed the abdomen had to be reopened, as there were evident signs of hæmorrhage, and one half of the ligature was found to have slipped over the pedicle. In spite of the infusion of saline solution the patient never rallied, and died the next day.

In another simple case, where the pedicle was also tied with the Staffordshire knot, a split in the pedicle below the ligature was discovered when the abdomen was reopened an hour after the patient had been put back to bed. It had apparently been caused by the pressure of the knot. This patient also never rallied.

There is always the possibility that some septic infection may be taken into the abdominal cavity on the silk, and the following are examples. An operator was seen to pick up a needle threaded with a piece of silk so long that it trailed on the floor before it entered the abdominal cavity; and on another occasion, when the specially prepared silk ran short, a further

supply was taken directly from a pocket-case, and was not purified in any way. Both of these patients died of septicæmia. Cases such as these are, undoubtedly, extreme examples of how septicæmia may be caused, and how necessary it is that the most minute attention be paid to every detail.

Examination of the Second Ovary.

After the pedicle has been disposed of, the other ovary must be felt; should it be enlarged it must be drawn up into view and visually examined. If the enlargement be due to the presence of a corpus luteum, sometimes called a blood cyst, the organ must be dropped back; but if there be a doubt as to whether it be diseased or not it is better not to remove it, if the patient be young. If undoubtedly diseased the whole gland should be removed, and there is no objection to using the cautery for this second pedicle.

A long pair of forceps holding a sponge is passed to the bottom of the pelvis to ensure that the peritoneum is dry, and that no hæmorrhage is going on. The omentum is then drawn down over the intestines, and a sponge is placed between it and the wound to catch any blood from the needle punctures. The sponges are counted by the assistant, while the surgeon is putting in the stitches; if the number be correct the sponge beneath the wound is removed, the stitches are tied, the dressing put on, and the patient is lifted back to bed. This describes an ordinary ovariotomy of the simplest kind; it will have lasted something under twenty minutes, and the risk incurred by a woman with a fairly good constitution will have been very little. Still the operation is not devoid of all danger. Simple operations such as this are not the rule, and we must now turn to the various difficulties and complications which may be encountered at any time or in any case.

Adhesions.

The first difficulty is met with when a tumour is adherent to the parietal peritoneum beneath the wound. When it is known that there is no bowel in front of the tumour, and this can always be made out during the examination, we can safely make the incision as usual through the probable thickness of the wall, and then go on cutting until the peritoneum is recognised. With parietal adhesions the distinctive appearance of the peritoneum, and also of the cyst, may be entirely absent; the peritoneum may be thickened and of a dull colour; and the tumour may not be whitish blue and shining, but dull and of a dirty or dusky red colour. If the point of division between the tumour and the peritoneum cannot be made out, it is better to open at once into the cyst than to run the risk of separating the wall before the peritoneum has been reached.

When the cyst has been opened the point of separation can be easily found. After a little experience there is not much difficulty in knowing when the peritoneum has been divided, unless the adhesions be specially close and firm, and the cyst wall specially thin. When the peritoneum has been divided without opening the cyst, and the tumour is not very large, say, less than 10 lbs. or 15 lbs. in weight, the adhesions are to be separated until there is a space exposed into which the trocar can be thrust. This is done, the fluid is evacuated, and after the trocar is withdrawn, the cyst opening is closed with a pair of forceps. The separation is to be continued with the fingers or a sponge. Towards the upper part the omentum will probably be come upon, adhering more or less to the tumour by its edge or by its flat surface. It is to be stripped off, and forceps are put on to any bleeding point. It is then got out of the way by pushing it on one side, or by turning it up over the upper surface of the wound, and enclosing it in a warm towel. Should there be much bleeding, an attempt may be made to reach the pedicle, if the broad ligament be not

opened up. The parietal adhesions are separated towards the pelvis, and if one get beyond them, as is often the case, the circulation through the pedicle may be stopped by compression with one or two large pairs of catch forceps ; another pair is put on close to the tumour, and the pedicle divided between them. By this plan the hæmorrhage from the tumour is lessened, and the adhesions may be often got at more conveniently by turning out the lower part of the tumour first. Recent adhesions, though often more vascular, are much more easily separated than those of old standing.

When the tumour is large, with a fairly strong cyst wall, and when the whole front of the anterior surface is adherent to the parietes, time may be saved by separating with the fingers a sufficient space to allow the hand to get in. This is done before the cyst is emptied. The hand and arm are swept over the whole of the anterior surface of the tumour, separating all the parietal adhesions with great rapidity. The hand must be kept flat on the tumour, must not be allowed to wander off into surrounding tissues, and must be able to distinguish bowel or other abdominal contents.

When the intestine is attached to the tumour, the connection can often be separated with a sponge, care being taken to divide the adhesions close to the tumour and not close to the bowel. Any bleeding points on the bowel must be tied at once with fine catgut. Should there not be room to do this, or should the peritoneal covering be torn, the pressure of a sponge wrung out of hot water may arrest the hæmorrhage, or the part may be touched with perchloride of iron in glycerine. This, combined with pressure, is always efficacious. Should the intestinal adhesions be both close and firm, it may be necessary, in very exceptional cases, to leave a piece of the cyst wall attached to the bowel. In such a case the outside layer alone is to be left, the secreting surface must be removed.

Should an opening be made into the bowel, the separation of the tumour must be stopped, and the rent sewn up at once.

Adhesions to the mesentery must be separated with the very greatest care and gentleness so as to injure the membrane as little as possible. The importance of this is evident, seeing that the blood vessels and nerves of the bowel pass through the mesentery, and that if the injury be very extensive it may even be necessary to resect the part of the intestine deprived of its blood and nerve supply.

The very greatest care must be taken in separating the liver and gall-bladder. Fortunately adhesions in these situations are not very common, for bleeding when the liver is injured is apt to be profuse. Pressure, with or without perchloride of iron, will be required to arrest it.

Should the gall-bladder be injured, it must either be removed entirely or a biliary fistula be formed. This is preferable to attempting to stitch up the tear.

Adhesions to the diaphragm and to the stomach are seldom met with; when to the former they may be troublesome, as interference with the diaphragm may cause stoppage in the respiration.

Adhesions to the spleen are apt, like those to the liver, to give rise to troublesome hæmorrhage during their separation. They also are rare.

Adhesions in the loins over the kidneys often give rise to much bleeding; the vessels are difficult to tie, and pressure, perchloride of iron, or the thermocautery may be required.

Destruction of kidney-substance during the separation of adhesions would cause extravasation of urine. It is doubtful if this has ever occurred, but division or ligature of one or even both ureters has happened. If this accident be discovered the ligature is cut; or if the ureter have been divided it may be possible to stitch the ends together. If the injury cannot be repaired, the renal end of the ureter must be brought outside the abdomen in the loin, or, if the patient be not too weak, the kidney ought to be removed at once. This latter plan is the

better practice, as a renal fistula entails untold misery and renders a subsequent operation necessary.

When a cord is come on during any abdominal operation, which may possibly be a ureter, one can determine whether it be the ureter or not by making pressure on it with the finger and thumb. If it be the ureter, within a very short time, perhaps a minute, the renal end will be found to have become slightly dilated.

Vascular pelvic adhesions are often difficult to ligature, especially when low down on the rectum; and it is much less trouble to ligature everything than to trust to the pressure of the forceps being sufficient. The laryngoscopic mirror is of immense service when looking for any source of bleeding in the pelvis. The intestines are drawn out of the way by one hand, and the light from the window is thrown down by the mirror. In this way the whole of the pelvis can be examined with ease.

Vesical and uterine adhesions are often very firm; they have to be separated with special care to avoid opening into the bladder. The uterine are very vascular. Should the bladder be opened, the rent must be sewn up at once with a continuous silk suture, and of course the peritoneal cavity must be washed out and drained.

After an adherent tumour is got out of the abdomen, sponges are packed in, in all directions, and the tying of the adhesions is begun. Occasionally large vessels in the peritoneum have to be tied, though, as a rule, the hæmorrhage from this part ceases spontaneously, or by the pressure of a sponge wrung out of hot water. Bleeding from the omentum must be stopped by tying the vessels, or, if the bleeding points be numerous, large pieces of the omentum may be ligatured with catgut or fine silk, and the distal portion cut off. The less the mesentery is interfered with the better; bleeding points are to be tied, and as little tissue as possible included in the ligatures.

Lessening the Size of the Tumour.

It is not always possible to reduce the size of an ovarian tumour by emptying cysts with the trocar alone. When there are several cysts and little semi-solid matter the trocar can be pushed from one cyst to another without withdrawing it from the original opening in the tumour. The hand must be used to reduce the size of the tumour when it is semi-solid in order to get it out through a comparatively small incision. Whenever it is possible the tension of the tumour is lessened by emptying even one small cyst, as this will allow the tumour wall to be grasped by Nelaton's forceps. The assistant, drawing on this pair of forceps, pulls the tumour forwards, and, if possible, over the edge of the wound, the trocar is then withdrawn and the opening enlarged with scissors. The hand, and if necessary the arm, is passed into the tumour to break down its interior in all directions; when the inside of the tumour is friable this is easily done; when more solid, much force may be required, or it may be necessary to divide the septa by cutting from the inside. During the breaking down it is essential that the assistant gives his entire attention to keeping the tumour opening well forwards to prevent anything entering the abdomen. When the tumour is so solid that the forceps cannot take hold of it, the mass is pushed well into the wound, and an opening is made to admit the hand. As soon as possible the cyst forceps are fixed on to the wall.

When the cyst wall is very friable the forceps are apt to tear out, and the assistant must be careful not to draw much on the tumour, being satisfied if he can prevent anything passing back into the abdomen.

Tumours Enclosed in the Broad Ligament.

Tumours which have grown between the layers of the broad ligament often present special difficulties. So much is this so

that unfinished operations appear usually to belong to this class. The reason of this seems to be, not that the cases present insuperable or sometimes even great difficulties, but that their exact relations are not properly understood. A reference to the diagrams on p. 318 will show how simple it is for an ordinary ovarian tumour to grow downwards between the layers of the ligament. When the tumour grows at first completely between the layers, without projecting upwards into the peritoneal cavity, it continues to grow in what is the direction of least resistance, viz. downwards, until it is brought to a stand by the bony pelvis; then the direction of least resistance is changed, and the tumour grows upwards, carrying with it on its upper surface the peritoneum, and pushing the uterus upwards and to the other side. In very rare cases, after reaching the pelvic walls, the tumour, instead of growing upwards, passes across in the pelvic cellular tissue behind the uterus, and raising up the peritoneum in the pouch of Douglas, passes into the other broad ligament. In this way the tumour, being below the peritoneum, raises the whole of the pelvic floor and contents into the abdomen as it grows upwards. In a case such as this the tumour may be entirely outside the peritoneum. When the tumour from its commencement grows both downwards into the pelvis and upwards into the abdomen, part of it, *i.e.* the lower part, will be between the layers of the broad ligament, and the upper portion will be in the peritoneal cavity uncovered by the peritoneal folds of the broad ligament.

It is impossible to say what is the proportion of cases where ovarian tumours grow between the layers of the broad ligament, for it is evident that the condition is often not clearly understood. In our experience the tumours grow either wholly inside the folds of the broad ligament or partly in about one case out of ten.

It will now be understood how the diagnosis of this condition is made. The uterus must be displaced to the opposite side from the tumour and is drawn up into the abdomen, as it

comes to be practically part of the tumour itself. It may be almost central when both ligaments are opened up.

The operation in these cases varies very much from the usual one. Suppose half of the tumour, which for convenience in description may be considered to be a single cyst, be covered by the distended folds of the broad ligament, and that there are no adventitious adhesions on the part of the tumour uncovered by these folds of peritoneum, it is evident that the stretched and enlarged broad ligament must be separated off the tumour. After the cyst has been emptied it will be found that it cannot be drawn through the incision, and on investigation it will be seen that there is no pedicle, but that the base of the cyst is very large. If the hand be inserted into the interior of the sac it will pass deeply into the pelvis below the apparent base of the tumour as seen from the peritoneal cavity. An artificial pedicle has to be formed by stripping off the peritoneum which surrounds the lower part of the tumour. The separation is begun at the edge, where the peritoneum ends on the sac wall, and it is to be continued in the direction of the uterus. Special attention must be paid to the bladder; it is better not to begin the operation with it empty; and as the enucleation gets deep down into the pelvis a careful watch must be kept for the ureters. During the enucleation keep close to the tumour wall and do not be tempted to wander off into the cellular tissue, or before long a ureter or a big iliac vessel may be wounded. It is not always easy to keep to the tumour, more especially if there have been any inflammatory attacks in the pelvic cellular tissue. To assist in doing this it is sometimes useful, when the pelvic part of the tumour is cystic, to enlarge the trocar opening so that the assistant can pass his hand into the interior of the cyst, and thus allow the operator to know exactly where the tumour ends and the cellular tissues begin. As the tumour sometimes dips very deeply into the pelvis, the enucleation may have to be continued down between the vagina and rectum, almost to the perinæum. During the enucleation, forceps are put on to every separated

piece of adhesion which seems likely to bleed, the large size of forceps being used when we come to the separation near the uterus. As oozing is usually free, sponges must be packed into the cavity from which the tumour has been enucleated, while the adhesions nearer the surface are secured with fine silk or catgut. When the forceps are fixed deeply in the pelvis the vessel enclosed should be tied without trying to see if the pressure has stopped the bleeding, for once lost bleeding vessels may be found again only with much difficulty and loss of time. It is wonderful to observe into what a small space the enormously enlarged broad ligament contracts. It may be left open, or may be stitched loosely together, the former being usually the better plan. If it be considered advisable to drain, the end of the tube should not rest in the opened-up broad ligament, but in its ordinary position at the lowest point of the peritoneal cavity, care being taken that there is no fold of peritoneum to make a pocket, and so prevent effusion from the injured cellular tissue from reaching the drainage tube.

An operation was witnessed where a drainage tube was placed in Douglas's pouch. The patient died of septicæmia, and on *post mortem* examination a pool of red serum was found in a pocket in each broad ligament, as there was no communication between them and the end of the drainage tube.

When the tumour is entirely behind the peritoneum, the method of enucleation is the same, except that at the commencement an opening has to be made through the posterior peritoneal lining of the abdomen.

A lady forty-four years of age was operated on, in February 1890, for an ovarian tumour, which filled the abdomen and reached up to the ribs. The tumour, composed of one large cyst, fluctuated freely, except above the pubes and Poupart's ligament on the left side. Here there was a solid mass, which was evidently the enlarged uterus. The tumour filled the pelvis, the vagina was drawn up in a funnel-shaped manner

towards the left, and the cervix could not be reached. The diagnosis was of an ovarian cyst without adhesions, but with extensive opening up of the right broad ligament. A free incision exposed an enlarged uterus; feeling sure of the diagnosis the incision was enlarged almost to the umbilicus, and the ovarian cyst was exposed beyond the fundus uteri. It was emptied by the trocar, drawn forwards, and fully half of the cyst was found to be covered by the expanded layers of the broad ligament. The enucleation was commenced in the usual way, beginning at the point farthest from the uterus and working towards it. When the separation had become very deep in the pelvis, the assistant kept his hand in the interior of the sac as a guide until the separation was completed. Some twenty or thirty pairs of forceps were fixed on to the divided tissue, the small pieces were tied with catgut and the larger with silk. Bleeding was free from the posterior surface of the uterus, from off the whole extent of which the cyst had been divided; several vessels were tied, but as the oozing was general, the capsule, *i.e.* the separated broad ligament, was stitched across the back of the organ to make pressure, which it effectually did.

A drainage tube was left in for sixty hours, and less than two ounces of bloody fluid were withdrawn. The patient slept almost continuously for the first three days, and went home within three weeks.

A patient aged forty-six was operated on in November 1886 for an ovarian tumour. The growth had been first discovered three years before, and during that time the patient had never been confined to bed with pain.

The tumour, softish and multilocular, extended up to the ribs, and was free in front. The uterus was felt to be raised up almost centrally on the tumour entirely out of the pelvis, but it was situated somewhat to the left. The cervix was drawn up to the left, and could barely be reached at the level of the pelvic brim. The whole of the pelvis was filled with a mass of tumour, which was slightly movable with the respiration.

A semi-solid ovarian tumour, with one, probably both broad ligaments opened up, was diagnosed. On opening the peritoneum the right Fallopian tube was seen immediately beneath the wound, and the broad ligament was found to be stretched over the entire surface of the tumour. The incision was enlarged up to the umbilicus, and the trocar was pushed into the tumour through the peritoneal covering, but only a little bloody fluid came away. The tumour was pushed forwards, the trocar opening through the posterior layer of the peritoneum was enlarged, and the enucleation was commenced. Fortunately the connections of the tumour were not very firm, and the enucleation got on fast. Forceps were put on anything likely to bleed, and at the last a couple of large pairs secured the uterine connection of the tumour. Sponges were packed into the gap made in the pelvic cellular tissue, vessels were tied with fine silk or catgut, the sponges were removed, and the other bleeding points were tied. Sponge pressure was used to stop a very free oozing. A drainage tube was put in, with the end in the cellular tissue, as that was the lowest part of the pelvis, the pouch of Douglas having been destroyed. The tumour weighed 17 lbs., the operation lasted fifty-five minutes, and though a careful watch was kept for the ureters neither came into view. On examining the tumour it was found that it had not been uncovered by the expanded layers of the broad ligament at any point.

The drainage tube was removed on the fourth day, seven ounces having been withdrawn. Progress was most satisfactory until the second week, when there was a slight attack of pelvic cellulitis, and the convalescence was in consequence prolonged to six weeks.

When a patient is put back to bed with a pulse of 140 or more, and when the heart shows no tendency to quiet down within twenty-four hours, the patient almost invariably dies, apparently from prolonged shock. The following is a typical example of such a case :—In December 1884 a patient twenty-seven years of age was admitted into the Edinburgh Royal

Infirmary. She had known of the presence of an abdominal swelling for about a year, and the case had been diagnosed as a very favourable one for operation. The patient was unable to lie in bed on account of severe abdominal pain, unaccompanied by any sign of peritonitis. The abdomen was distended by a tense cyst, and on vaginal examination the cervix was felt to be pushed downwards, the body being lost in the cyst. The urine was passed frequently, its specific gravity was 1012.

The operation was performed on the 17th of December. The incision was made from the umbilicus downwards, and on opening the peritoneum the tumour was found to be covered by a thickened broad ligament. The cyst was emptied, and the tumour drawn as far forward as it would come. It was then found that the right broad ligament was stretched over the whole of the tumour, and that the uterus which was enlarged was intimately connected to the left side of the cyst. The bladder was closely incorporated with the enlarged uterus in front. The broad ligament was separated, and after a large number of forceps had been used to arrest the hæmorrhage, which was very profuse, the cyst was removed. Nine spouting arteries were ligatured on the posterior surface of the uterus, and a large number of bleeding points were secured in the capsule and in the pelvic cellular tissue. Dr. Keith tried to draw the uterus upwards so as to remove it, but was prevented from doing this by the remarkably close connection of the bladder. The abdomen was then thoroughly sponged, and a clamp was put on the separated uterine stump, because the uterus fell back into the pelvis in such a way that drainage could not have been efficiently carried out. The operation lasted rather more than an hour, and the tumour weighed 12½ lbs. The patient was put to bed shortly after one o'clock. The pulse was then 140.

5.30 P.M.—Did not wake up till after three o'clock. At four ten ounces of clear water were drawn off by the catheter. P. 140.

Shortly after this she began to complain of a very bad

stomach-ache, one-sixth of a grain of morphia was given, and in a few minutes she fell asleep. Urine ten ounces.

9 P.M.—Has been very quiet. Fully three ounces of bloody fluid from the tube and in the sponges. Expression good. Twenty-one ounces of urine. One-sixth of a grain of morphia. Fifteen minims of tincture of digitalis by the rectum. T. 100·6°, P. 178.

18th, 6 A.M.—A quiet night. Digitalis repeated. T. 100·4°, P. 176.

10 A.M.—Not much more than an ounce from the tube. Urine passed frequently in small quantities, and contains a considerable amount of mucus with a little albumen. Stomach flat, no sickness, a third dose of digitalis. T. 100·4°, P. 160.

1 P.M.—Feels tired, but is dozing. T. 101·4°, P. 168.

5.30 P.M.—Has been sleeping soundly. Nutrient enemata have been given all day, now quinine is to be added. T. 101·4°, P. 168.

9.30 P.M.—Flatus is passing very freely. Expression natural. No sickness. One ounce from the drainage tube. T. 101°, P. 168.

19th.—Had a fair night, flatus passing freely. One ounce of clear serum from the drainage tube. P. 160.

At 11 A.M. the pulse had come down to 156, and the temperature was 101·6°. During the day the patient was able to retain food, flatus passed freely, and the pulse varied from 158 to 168. On the morning of the 20th the patient was in much the same condition, and was looking perfectly natural. She had not become thin, the pulse was weak at 160. As the day went on the pulse became more feeble, and about four o'clock she died. One hundred and fifty ounces of urine were passed in the seventy-five hours she lived after the operation.

A case when the patient recovered where the symptoms were very similar to those seen in the foregoing instance may also be given :—The patient was thirty years of age, and the operation was performed on the 15th January 1890, a non-adherent

ovarian tumour being removed along with the second ovary. The operation lasted less than twenty minutes. On being put back to bed about three o'clock the pulse was 145.

9 P.M.—Restless. Nutrient enemata with brandy were commenced. One-sixth of a grain of morphia. T. 99·2°, P. 156.

16th.—Inclined to be restless and talkative all night. One-hundredth of a grain of strychnia and 2½ minims of tincture of strophanthus were injected. T. 99·8°, P. 156.

9. P.M.—Much the same. The strychnia and strophanthus have been injected every four hours. Flatus is passing freely, and there has been no vomiting. The pulse is still 156.

17th.—No change all day. Is taking food well, there has been no trouble with the urine. T. 98·8°, P. 154.

18th.—There was no improvement till the evening, when the pulse fell to 145. The strychnia was stopped as the neck was getting a little stiff, and five minims of strophanthus were given by the mouth every four hours instead of hypodermically, as the large number of injections which had been given had made the arms very tender and painful.

19th.—The pulse was down to 135, but it did not fall below 100 for eight days. At that time the strophanthus was stopped. During the whole progress of the case, the danger was evidently limited entirely to the condition of the heart, the abdomen having given rise to no trouble.

Partial Removal.

It sometimes happens that it is impossible to remove the whole or a part of an ovarian tumour. With increased personal experience such cases naturally become more rare. As a general rule it is advisable to go on and finish the removal if possible; still there are cases where the patient's chance of recovery will be better if the operation be not completed. It is always hard to stop an operation before it is satisfactorily completed, but if this have to be done it is better to make up one's mind

to do it soon. As the patient recovers much more quickly after complete removal, the extirpation of a cyst must not be given up lightly, determination will carry one through a good deal. When the tumour, instead of being cystic, is more or less solid, the operation if once begun must be finished at all risks.

The conditions which make it necessary to perform a partial removal are close or very extensive intestinal adhesions, intimate adhesion of the tumour to the aorta, and an occasional enucleation case in the pelvis, where the connections of the cellular tissue are very firm and dense. In this latter case it is sometimes possible to complete the operation by removing the uterus along with the tumour.

A lady forty-two years of age was operated on for an ovarian tumour in 1886. The broad ligaments were known to be opened up, and at the operation two ovarian tumours were found, each having opened up its broad ligament. The enucleation was extremely difficult, and a small piece of the cyst was left adherent to the rectum. On account of the difficulty of enucleating the cyst it was found that the safest plan was to remove the uterus, which was high up and almost central. A clamp was put on round the neck and below the base of the cysts. When the clamp began to loosen at the end of a week fæces commenced to pass alongside the stump, but this did not inconvenience the patient much, and by keeping the wound clean the opening had healed up twenty-eight days after the operation. The mass which was removed consisted of the ovarian cysts of the greater part of the uterus, and of two dilated Fallopian tubes.

A surgeon with a fair amount of experience will be unable to complete a case perhaps once or twice in one hundred operations. Such cases must always be looked upon as unsatisfactory, and partly in the light of failures.

When the cyst is adherent to the parietes, and it is determined to make no attempt to remove the tumour, the operation is a simple one,—the incision is made directly into

the cyst, the contents evacuated, and the cavity thoroughly dried. One or more glass or rubber drainage tubes are put into the sac, and plenty of iodoform and absorbent cotton are used as the dressing.

This is practically treating the case like an abscess cavity; it is only likely to be necessary when the cyst is suppurating, or when the patient is weak, and the adhesions are known to be extensive. If the tumour be not adherent in front, or if part have been separated, the operation is rather more complicated, especially if the sac wall be very thin. Silk stitches are first put in to lessen the size of the parietal wound if necessary; then one or two are passed through the whole thickness of the wall on one side, taking in a larger amount of peritoneum than usual, then through the sac, and the abdominal wall on the other side. This is done both at the upper and lower angles of the tumour. A stitch is passed through the parietal and cyst walls not more than one-third of an inch from the angle stitch, it then returns through the cyst and parietal wall on the same side one-third of an inch farther away from the angle. Stitches passed in a similar way fix the rest of the cyst to the abdominal wall, and when they are tied they bring the sac close to the peritoneum.

The cyst is cut off, leaving half an inch or so above the stitches, and this part of the sac wall is thoroughly dried with the solution of perchloride of iron in glycerine. In this way the sac remains open, and is in much the same condition as if it had been adherent beneath the wound. Should there have been much separation of adhesions in the peritoneal cavity, it may be necessary to leave a drainage tube there, as well as in the sac itself.

There is usually wonderfully little discharge, and there may or may not be suppuration. When suppuration occurs there is some rise in temperature, beginning from the third to the fifth day, and in this case the sac ought to be washed out at least twice a day with boracic lotion or other antiseptic which cannot

do harm. A sinus seldom remains for longer than two or three months, though in some cases it becomes permanent.

The tumours which lend themselves to this method of treatment are either unilocular, or those where several cysts can be broken down into one.

Fibroid Tumours of the Ovary.

Ovariotomy for fibroid tumours of the ovary does not differ in any particular from the foregoing descriptions, except that, as the tumours are solid, a longer incision will be necessary. Fortunately they are not only rare, but seldom reach to any great size. The largest of the three which we have seen did not weigh more than 10 lbs. Their practical importance is not great; they consist of pure fibrous tissue, but this is only made out on microscopic examination after the operation.

Cysts of the Broad Ligament.

There seems to be a certain amount of confusion about cysts of the broad ligament. They may arise from the parovarium, or in the broad ligament itself. Their symptoms are very much those of a unilocular ovarian tumour, except that they do not give rise to the general effects of such tumours. They grow slowly, five or even ten years often elapsing before any treatment is called for. They are seldom tense, the abdomen is less prominent than in an ovarian tumour, fluctuation is well marked, and the cyst wall feels thin. Frequently they are felt on pelvic examination, as they are not uncommonly without a pedicle, but are sessile on the broad ligament, and may have opened up its layers very extensively. When this latter conditon is present, the uterus will be displaced upwards and to one or other side. They do not cause pain, and do not tend to become adherent. There is little or no thinning of the chest and arms. The slow growth, the want of general symptoms, the thinness of the sac

walls, and the flaccidity of the sac itself, are the most important symptoms.

The treatment is either by aspiration or by removal. Now that abdominal surgery has made such great advances, the operation of ovariotomy for a simple cyst is so devoid of danger, that removal has come to be the common way of treatment, and little or no attention is paid to the diagnosis as between ovarian and broad ligament cysts.

Broad ligament cysts not infrequently rupture; when this happens there are seldom if ever any symptoms beyond the passage of large quantities of clear urine. This is the simplest method of cure. The nearest approach to it is by aspiration. This simple and safe operation cures the great majority of cases; the women in whom it is most certain that the sac will not refill are the young ones. In middle-aged and old women a repetition of the aspiration may be required. Should the fluid collect quickly, the best plan is to remove the tumour. Aspiration should always be tried first, it confines the woman to bed for a day or two, it is free from all risk, and no weak point is left in the abdominal wall. The fluid in all the flaccid cysts, so far as our experience goes, is as clear as spring-water. Should the fluid be found to be of a different appearance, one need not expect that the tumour will not refill, and it is probable that a mistake in diagnosis has been made.

The operation of removal is often extremely simple, and even should the broad ligament be opened up, the enucleation is very much more easy than in the case of ovarian tumours which have opened up the broad ligament. In other respects the operation and after treatment do not differ from that of an ordinary ovariotomy.

Tumours connected with the Broad Ligament.

A soft œdematous tumour of the broad ligament is very rarely met with. As such a tumour will in all probability be

indistinguishable from a solid or semi-solid ovarian, nothing need be said as regards diagnosis. The pedicle may be long, and in such a case the operation is of the most simple description.

A patient fifty-two years of age was sent to the Edinburgh Royal Infirmary in the end of 1886. She had noticed that the abdomen was enlarging for about three years, and latterly she had been getting thin about the chest and arms. On examination, what appeared to be a semi-solid tumour was found entirely filling the abdomen, the largest cyst was on the left side, and the tumour was free in front. The diagnosis was made of a multilocular ovarian tumour. A free incision was made from the umbilicus to within an inch of the pubes, and on opening the peritoneum the tumour looked like an œdematous fibroid. It was turned out of the abdomen, and was found to be attached to the broad ligament by a long narrow pedicle consisting almost entirely of blood vessels. The left ovary, small and atrophied, was situated midway on this pedicle. The right ovary was also atrophied. The tumour was a remarkably soft œdematous fibro-cyst growing from the broad ligament. It weighed $14\frac{1}{2}$ lbs.

CHAPTER III.

DISEASES OF THE OVARIES AND FALLOPIAN TUBES.

The operation of removal of the ovaries and Fallopian tubes is usually known by the name of removal of the uterine appendages, though they are appendages only in the surgical sense. It is an operation of recent date. Blundell, however, in the year 1823, suggested that the operation, or at least removal of the ovaries, was a right and proper one for cases of dysmenorrhœa and menorrhagia. Fifty years elapsed before his advice was put into practice. There has been much controversy as to whom the credit of the operation belongs, and if we leave Blundell out of account it will rest between Battey, Hegar, and Tait. The operation was greatly extended by the last named, and his teaching has undoubtedly resulted in the performance of many unnecessary operations. Although there is still a difference of opinion in regard to the frequency with which it ought to be performed, yet there ought not to be the slightest doubt about the advisability and even the necessity of this operation in suitable cases.

As the operation is not always necessary to save life, but is only to alleviate suffering, and to allow a woman to lead a useful instead of an invalid life, it is only fair that she should be made clearly to understand the exact nature of the operation. It is not sufficient, nor is it right, to say simply that two little glands must be removed ; the patient must be told that the result of the operation will be to bring about the " change of life." At

the same time she may be told, when an operation is necessary, that the disease has rendered the ovaries unfit to perform their duties, and that it is almost impossible that she can bear children.

The conditions for which the removal of the ovaries and Fallopian tubes is to be performed may be divided into two classes,—the one where there is actual disease in the ovaries and tubes; and the other where they may be healthy, but are removed to bring about a change, either in some other organ, or in the general condition of the patient.

The first class may be divided into cases where there is suppuration, and into those where suppuration is not present. The disease may be in the ovaries, in the tubes, or in both, and there will be also in a certain number of cases a varicose condition of the veins in the broad ligament.

The ovaries may be inflamed—ovaritis,—cirrhotic, suppurating, or misplaced. The Fallopian tubes may be inflamed—salpingitis,—may be distended with simple fluid—hydrosalpinx,—with blood—hæmatosalpinx,—with pus—pyosalpinx,—or with a fœtus—extra-uterine pregnancy.

Healthy ovaries may be removed to make an artificial change of life, and thus arrest the growth and cure the symptoms of a fibroid tumour of the uterus; for the same purpose they may require to be removed in cases of infantile uterus; and in some cases of mania and epilepsy good success has been obtained by their excision.

The operation is not justifiable in cases of uterine dysmenorrhœa, nor when the patient is simply neurotic and when no actual disease can be found in the pelvis.

There is no difficulty in advising operation when there is suppuration, either in the ovary or tube. If the condition be one of chronic inflammation only, and under this may be included distension of the tubes by simple fluid, it is often a difficult question to decide when the disease can only be cured by operation; and great help may be obtained from the patient's friends as to the amount of suffering, her own statements being

received with caution. The operation for the removal of the appendages for uterine fibroid will be taken up in its proper place, in connection with the treatment of these tumours.

Cases of infantile uterus are very rare, but in some the removal of the ovaries may be necessary.

In mania and epilepsy much care must be given to the consideration of the case before operation is advised, and it must only be done in the early stages of these diseases.

What has been long known as pelvic peritonitis or pelvic cellulitis is now generally recognised as not being, as a rule, a primary disease in itself, but a result of some altered state of the uterine appendages.

There is a considerable amount of difference of opinion as to what is the cause of disease of the uterine appendages. This may be accounted for by the fact that the causes are numerous, and that it is often impossible to prove a direct relation between the cause and the effect. For convenience we may consider the appendages as one, and not the ovaries and the tubes as separate.

The whole generative tract may be looked on as one continuous tube, commencing at the vulva and ending at the ovaries; the vagina, uterus, and Fallopian tubes being included in the canal. An irritation, whether specific or not, at one part of this tube, may spread throughout its whole length, and will give evidence of its presence at its weakest part.

Causes.—Inflammatory disease of the uterine appendages can usually be traced to an abortion; to the birth of a child; to a simple chill during menstruation; to a gonorrhœal infection at any part of the generative tract; to the passage of a sound when the vagina has not been purified, and especially if the instrument be so roughly used that a small abrasion of the uterine lining surface is made, thus forming a perfect nidus, possibly at the very mouth of one Fallopian tube, for any vaginal bacteria to propagate.

Laceration of the cervix uteri, while secondary to delivery, is a cause of some frequency.

As an example of the disease following an abortion, the following case may be given. A lady thirty-two years of age aborted at the end of the third month. For ten days afterwards the progress was not very satisfactory, the temperature was a little over 100°, and the pulse was slightly quickened. For the next fortnight she was apparently quite well, but was kept in bed as a precautionary measure. At the end of that time, that is, nearly four weeks after the abortion, a slight attack of fever was noticed every afternoon, and in a few days the rise in temperature became steady. Examination showed the presence of a swelling on each side of the uterus. These increased rapidly, and the patient was advised to have them removed, but she would not consent, and at the *post mortem* held eight weeks after the abortion both tubes were found to contain about half an ounce of pus. There was no history of gonorrhœa.

An example of the disease following the birth of a child is that of a woman twenty-eight years of age, who was delivered after being two days in labour. She was unable to get out of bed for three months. Since that time she was able to do very little, and on three occasions had been in bed for over a month at a time with an attack of so-called pelvic peritonitis. The patient was practically useless, and a mass could be easily felt on each side of the uterus. The ovaries and tubes were removed in 1885, twenty-seven months after the birth of the child. Within six months the patient was able to say that she felt as well as she had ever done in her life, and she has been in constant employment from that time.

The following is the history of a case, due to a chill caught while menstruating, treated by an American surgeon. A lady thirty-seven years of age, who was in perfect health and without any history of disease of the uterine appendages, got up one evening in her night-dress while menstruating to shut a window. It was winter-time, and the thermometer showed about 10° of frost. By the time she got back to bed her feet were cold, and there was no hot bottle in the bed. An hour afterwards she had a

shivering fit; when she was seen two hours later the temperature was 105° and the pulse 135. On vaginal examination the pelvis had the plaster-of-Paris feeling, and the lower part of the abdomen was tender. The patient lived for three months with a temperature never below 101·5°. Five days before death the abdomen was opened, the ovaries and tubes were found to be much enlarged and matted together, but no pus was found anywhere.

As an example of gonorrhœal infection, a lady twenty-five years of age had contracted gonorrhœa from her husband three years before, and had suffered from that time from general malaise and occasional attacks of pelvic peritonitis. On examination the right tube was found to be distended, the uterus was enlarged and retroverted, and the temperature when she was first seen was 103°, with the pulse at 120. Immediate operation was strongly advised, but was not consented to for eight days. By that time the temperature had risen to 106°, and the pulse to 140. The patient and her friends then gave their consent. The right tube, containing two ounces of stinking pus, and with walls fully half an inch in thickness, was removed. The left tube presented a perfectly normal appearance. The patient only survived twenty-two hours.

It would be very difficult to prove that the passage of a sound is actually the starting point of this diseased condition, but it is undoubtedly the case that the symptoms may be aggravated after this has been unskilfully done. A patient twenty-six years of age had sought relief at two teaching institutions on account of general debility and pain in the back and sides, from which she had suffered more or less for six years. Although no complaint was made, it was very evident that the symptoms had been much aggravated by the treatment she had received, and on guarded inquiry it was found that a sound had been frequently passed by the students. At the operation in June 1886, both ovaries were found to be enlarged, the tubes were dilated, and the walls were thickened.

As an example of disease resulting from laceration of the

cervix, a patient twenty-nine years of age was seen in July 1880. She had suffered, since the birth of her eldest child six years before, from constant burning pain in the lower part of the abdomen and back, very much aggravated at the time of the period. The patient was emaciated, and her medical attendant reported that she had been a big stout woman. On examination the tubes could be felt with the greatest ease on account of the thin lax condition of the abdominal wall; they were hard, and felt as thick as the finger; the ovaries were tender, but otherwise appeared to be normal. The cervix was large, hardened, and deeply lacerated. The condition of the tubes and ovaries was confirmed by Dr. Howard of Baltimore and Dr. Maury of Memphis, and they advised that the tear in the cervix should be sewn up after some preliminary treatment; but they both thought it probable that the tubes would have eventually to be removed. Their advice was followed. Three weeks after the operation the pain had almost disappeared, and the patient was beginning to gain weight. The left tube could not be made out, and the right felt soft, and about half the thickness it had been before the operation. Four months afterwards, the doctor reported that the patient was perfectly well, and had gained so much in weight that her waist had increased five inches.

Accompanying and perhaps acting also as a cause of disease of the appendages must be included a varicose condition of the veins in the broad ligament.

A lady thirty-seven years of age, seen in 1893, was suffering from constant pain in both groins, in the thighs and back, with a feeling of weight in the pelvis and inability to stand. Treatment by injections of hot water and astringent applications to the vagina had been frequently used, always with benefit, but the good effects never lasted for more than a month or two, and the patient was very anxious to be made quite well. On examination both ovaries were felt to be somewhat enlarged, the right was prolapsed, and the tubes were hard and slightly dilated; in

addition there was the feeling similar to what had been noticed in cases where varicose conditions of the veins in the broad ligament had been seen at other operations. At the operation two large bunches of veins were found in the broad ligament which formed the pedicle. They were removed along with the somewhat enlarged tubes and ovaries. The feeling of weight and the pelvic pains were relieved, and the patient is steadily gaining in every way.

Symptoms.—Where there has not been suppuration the symptoms are varied indeed, and may be divided into local and general. The local symptoms are pain in one or both groins, in the back, in the front over the pubes, down one or both thighs, in the hips, in the groins on raising the arms above the head, and a sensation of weight and general discomfort in the pelvis. These pains may be acute, or of a dull aching character; they may be constant, and are usually worst about the menstrual period, sometimes between the periods, and at times they may be almost or quite absent in the middle of the month. In certain cases there is pain or a feeling of obstruction when the bowels move. In addition there are usually recurrent attacks of more or less severity of pelvic peritonitis, when all the symptoms are aggravated, and the patient is confined to bed with usually some rise in temperature. As regards the amount of menstrual flow there may be no alteration, or there may be either an increased or a diminished quantity.

The following is a typical history of this condition :—A young woman thirty years of age was delivered of her only child three years before operation. After the birth she made a bad recovery, and did not feel well when she got up. Since then she could do little work, and a day's washing would send her to bed for two or three days. On several occasions she had been confined to bed for a few weeks at a time with increase of symptoms and fever. She suffered from constant pain in both groins, bearing down, and pain in the back; all worse before and during menstruation. There was some increase in menstruation. Life

was said to be not worth living on account of the general misery. Examination during one of the acute attacks revealed nothing except a very well marked plaster-of-Paris feeling in the pelvis. Before the operation the uterus was large, fairly movable, and enlarged ovaries and tubes were easily made out.

The constitutional symptoms consist in a breaking up of the general health. After a longer or shorter time, depending on the original constitution of the patient, she begins to lose flesh, becomes poorly nourished, takes her food badly, suffers from constipation, is unable for much fatigue, cannot walk or stand, has frequent headaches, is anæmic, irritable, and sooner or later loses control of her nervous system and becomes hysterical. There may be also pain in the breasts.

A lady thirty-three years of age, the mother of three children, and who had never been robust, had gradually failed in health since the birth of her first child. After the third she became a semi-invalid, she suffered chiefly from pain in both groins and down the thighs, from dyspepsia, constipation, headache, and loss of strength. She became terribly thin. All these symptoms, and especially the dyspepsia, were much aggravated during the menstrual periods. At those times she was unable to retain anything on the stomach, and latterly rectal feeding had to be resorted to. During the last period before the operation, this had to be continued for eight days, absolutely no food being taken by the mouth for that time. Treatment of all kinds had been thoroughly tried and had failed. The uterus was large and heavy, the ovaries were tender to the touch, but were not larger than natural, and they appeared to be adherent. The debility had increased so much that it was evident that the patient would die if something were not done. The operation was therefore performed in June 1888. The ovaries were rather smaller than natural, hard and adherent; the tubes appeared to be normal. Progress in every way was extremely slow, and at the end of one year little strength seemed to have been gained. The pain was, however, very much less, the sickness had stopped,

but the headaches were still frequent. She got on better in the second year, but it was two and a half years before she was able to go to a dinner party or to the theatre.

The symptoms caused by the presence of pus in an ovary or tube may sometimes be extremely slight ; indeed, cases have been known where there were no symptoms except the abdominal swelling. When present they are usually those already described in the case of simple inflammation, and in addition shivering or a feeling of chilliness, sweating, and a certain amount of fever. The disease becomes at times acute, and the attack is ushered in with a rigor.

An example of this condition without symptoms is the following :—A married lady thirty-two years of age came for advice on account of increase in size of the abdomen, though there had never been any pain or discomfort. A peculiarly irregular tumour was found extending up to the umbilicus, fluctuation was indistinct, and on vaginal examination the tumour could barely be reached, the uterus was movable. The disease was diagnosed as an ovarian tumour, but turned out to be the Fallopian tubes enormously distended with pus ; the smaller held one pint, the larger about half as much again.

An example of an acute attack may be given :—A patient thirty-eight years of age was seen in consultation in 1890. Since the birth of her last child nearly three years before she had suffered from pain in the groins and thighs, and a swelling in each broad ligament had been discovered, which was supposed to contain pus. The patient had refused to have the swellings removed, and the reason for the consultation was a sudden rise in pulse and temperature following a rigor. Two large sausage-shaped masses were felt, and operation was strongly advised, but the patient declined to have anything done, and she collapsed and died about a week afterwards. A rupture was found at the *post mortem* examination.

Diagnosis.—The physical diagnosis is often difficult on account of the exquisite tenderness either in the whole pelvis or

at one or other part of it. The first thing to be noticed is that the mobility of the uterus is lessened, and that it cannot be moved as freely as usual without causing pain. The broad ligaments convey a feeling of contraction and of resistance to the finger. The hand placed on one or other side of the middle line of the abdomen is to be pressed deeply backwards in the direction of the pelvic brim, while the finger in the lateral fornix is directed far back in the pelvis, meeting as nearly as can be the outside hand. The two hands being now brought forward, everything which had been in front of them can be examined. Should a tender swelling be discovered, information must be obtained by feeling round the part, and not by continuing the pressure on the tender spot.

It is impossible to tell in words the feeling conveyed to the fingers by diseased uterine appendages. There may be a slightly enlarged and tender ovary, with perhaps in front of it a cord very much the size of a cedar-wood pencil—the Fallopian tube; or the uterus and pelvic contents may seem to be inextricably matted together; or there may be an intermediate condition, where an enlarged rounded ovary or a sausage-shaped swelling is felt behind the uterus.

Treatment.—When disease is found on examination, the treatment will greatly depend on whether the presence of pus is suspected or not. If there be pus, general surgical principles must be applied and the poison got rid of by operation. When there is not pus, a less severe mode of treatment must be first tried, unless the tubes be evidently greatly distended. Rest, complete rest, either alone or in combination with other treatment, is essential, and by complete rest is meant not lying down on a couch for part of the day, but absolute confinement to bed. In no other way is it possible to keep a patient quiet, and in bed she can also be kept warm. At this stage a "hot pack" should be given every day; a couple of sheets are folded up into broad roller bandages, one is wrung out of hot water and wound round the pelvis, going as high as the navel and well down on to the

thighs. The second sheet is used dry to cover the first. The sheets are kept on for an hour, and after they are taken off perspiration is encouraged by a hot bottle at each side, as well as one at the feet, which should never be allowed to be out of the bed. This packing is to be continued for a week or ten days.

Hot water is to be injected twice a day for fifteen minutes at a time. After this, the lower part of the abdomen is to be painted as often as the skin will bear it with Churchill's tincture of iodine. The top of the vagina is painted three times a week with the same preparation of iodine, and this can only properly be done through a Sims' speculum. Pads of wool saturated with glycerine are also placed against the swelling after the iodine has been used. If the case improve, the patient at the end of six weeks is allowed to get up for an hour, and then for longer according to the progress made. The general health must be attended to, and often an hour's massage in the day will improve the general nutrition, and help the patient to sleep. Should there not be any improvement at the end of six weeks it is not advisable to continue the local treatment. On the other hand, if there be any improvement, even though it be slight, the treatment must be continued.

Patients with inflammatory disease of the uterine appendages seldom come for treatment in the early stages, and have often seen numbers of doctors, changing from one to another as they are disappointed with their slow progress. It must be strongly impressed on every one that under the best of circumstances progress will be slow, and that it may be several months before any great improvement is felt.

As an example of the progress made by those cases, the following history may be given:—A young married lady twenty-four years of age, whose only child was four, was brought over to London in October 1892, in an invalid carriage from the South of France. The illness dated from a chill caught while menstruating eighteen months before. She suffered chiefly from pain in the back and general debility until the beginning of August 1892,

when she was seized with a very acute attack of pelvic peritonitis. Examination at that time showed that the uterus extended half way up to the umbilicus, and that the whole of the pelvic contents were matted together, one enlarged ovary being felt immediately behind the cervix. She was treated by a well-known French gynæcologist, who was afraid that the ovaries would eventually have to be removed. When she arrived in London in the beginning of October, she was found to be emaciated, and to be suffering constantly from pelvic pains, and from a severe back-ache. On examination the uterus was found to be enlarged, the left ovary was prolapsed, tender, and swollen; both Fallopian tubes felt as thick as the forefinger, and the right ovary appeared to be enclosed in a mass of adhesions. On comparing the condition with the written account which the patient had received in France, it was evident that there had been a marked improvement in the local condition, although the patient did not feel much better. The treatment consisted in hot water injections for twenty minutes three times a day, in absolute rest in bed, in general massage for one hour every day, and in the administration of suitable tonics. This treatment was continued for eight weeks with marked benefit. Shortly afterwards the patient became pregnant, and was delivered of a healthy child in November 1893.

Another method of treatment consists in rest combined with Dr. Apostoli's treatment. As electricity for such conditions is in an early stage of development, it is impossible to say if cases can be permanently cured by its means. Some are cured at least for a time, but our experience is not sufficiently old to allow us to say that there will not be a return of the disease. The method will be described when the treatment of uterine fibroids is taken up. The passage of a constant current of electricity appears to be able to give positive information whether the uterine appendages are diseased or not. If they be diseased, patients cannot bear a large dose—10, 20, or 30 milliampères will be about the maximum.

The wife of a doctor, twenty-eight years of age, who had been married four years, had suffered from dysmenorrhœa for about six years, the starting point being a chill got while riding one wet day. She was first examined about the beginning of 1890 on account of constant pain in the back, dysmenorrhœa, and general debility. As there was no improvement she saw the late Dr. Matthews Duncan, who diagnosed inflammation behind the uterus, either in the tube or ovary, and advised rest, and perchloride of mercury with chloride of calcium. There was still no improvement, and the husband took her to see Mr. Tait. His diagnosis was occlusion of the left Fallopian tube, which was distended with fluid; probable occlusion also of the right tube, as there had not been any family. Hopeless sterility. He said two courses were open, either to go on suffering with the prospect of cure at the change of life, or to have the appendages removed. Nothing else, he added, would do good; and if the pains were not so severe as to make her desire the operation, she must not undergo any treatment, for nothing could give her any relief.

On examination a few days afterwards, Mr. Tait's diagnosis was confirmed; and in addition there was a well-marked retroversion. The tube seemed to be about an inch in diameter at its widest part, and stretched across the whole of the left fornix, behind the uterus, and into the right side of the pelvis. The lady could not make up her mind to the operation, and it was therefore suggested that she should try experimentally Dr. Apostoli's treatment, being assured that it would at least do no harm.

The first ten applications averaged less than 40 milliampères; the next eight, fully 70; and then seven punctures were made of 30 milliampères. At the first period there was rather more pain, but after that was over improvement, both general and local, was marked. At that time there was a swelling the size of a large marble. The patient went home, and was to come back if necessary.

In the following year twenty applications were made, though the patient was better in every respect.

In February 1892, the husband wrote: "I am thankful to say that she is immensely better, thanks to your treatment; the periods are now practically painless."

An example where this treatment was tried and failed was seen in a lady twenty-seven years of age, who suffered from severe intermenstrual pain. On examination the uterus was felt to be fixed, and to the left and low down there was a very tender swelling, which was diagnosed to be an enlarged ovary. Thirteen electrical applications were made without any benefit. Operation was therefore performed in May 1891, when the ovaries were enucleated with great difficulty from between the folds of the broad ligaments at the very bottom of the pelvis.

Improvement after this form of treatment may not be very marked for some months.

No operative treatment is to be countenanced in cases of simple neurosis. The symptoms may greatly resemble those caused by disease of the ovaries or tubes, but the local signs will be entirely absent.

When the diseased condition of the appendages appears to be caused by the irritation of a lacerated cervix, Emmet's operation must be performed. This may be safely done, provided that the uterus be not drawn down. Should the uterus be much dragged on during the operation, it is likely that an attack of pelvic peritonitis will be lighted up.

The Operation of Removal of the Ovaries and Tubes.

The appendages are usually removed through a short incision, not that there is any very special advantage in such an incision, other than that there is so little exposure of the intestines that the operation is practically subcutaneous. The two fingers of the left hand, with which the operation is usually performed, quickly become educated to recognise the different structures to be met with. If the surgeon be in doubt, he should never hesitate to enlarge the incision, push the intestines out of the

pelvis, and keep them away with sponges, while light is thrown into the pelvis either from the reflector or an electric lamp. During difficult operation cases, touch is a better guide than sight, for it is impossible in such cases to trace the tube from the uterus as has been recommended. Indeed, this cannot sometimes be done even when the parts have been removed. The elevation of the pelvis, so as to allow the intestines to slip into the abdomen, as recommended by Trendelenburg, is therefore not considered advisable. The incision is to be made in the middle line in the way described on page 45, care being taken not to bring it too near to the pubes. When the peritoneal cavity has been opened, the two fingers of the left hand are passed in, and, keeping close to the peritoneum, are insinuated behind the pubes, over the bladder to the fundus uteri, then running along one broad ligament for an inch or two, they get hold of the tube from behind, and as it is drawn up the ovary follows. The ovary and tube are drawn well up into the wound, and the pedicle which is thus artificially made is transfixed and tied in the usual way. The assistant, who holds up the ovary, makes no tension while the ligatures are being tied. The point transfixed is to be made as close to the uterus and as far away from the ovary as possible. The ends of the silk ligatures must be at once cut short to prevent traction. The ovary and tube are then removed, the pedicle being divided with short snips of the scissors, and the cut surface is carefully examined as the separation is made. The appendages on the other side are removed in the same way. For a simple case such as this the cautery acts extremely well, and is a great improvement on the ligature, as it prevents a foreign body being left in tissues which are likely to be in a state of irritation or inflammation.

Such is the operation in the rare non-adherent cases. It is a more difficult matter when there is much adhesion, either in the pelvis or to the intestine. It may be impossible to reach the uterus in the way described without having to break through a layer of adhesion, but it is always advisable to make out the

exact position of that organ before commencing any separation in the pelvis. Occasionally when the uterus is retroverted and firmly fixed in that position, help may be obtained by an assistant raising the pelvic floor from the vagina. After the uterus has been reached, the fingers are passed to one or other side behind the broad ligament, and the separation is begun. It is often difficult to commence the enucleation, and much force may be required. If the ovary or tube be distended with fluid, the sac is emptied with the aspirator after sponges have been first packed in to catch any drops of fluid which may escape. After the sac is emptied the cannula is withdrawn and the opening closed with forceps; it can then be drawn up high enough to be seen, and the separation is continued as in an ordinary case of pelvic enucleation, the finger being kept in the interior of the sac if necessary. When thick walled the separation is more easy when the sac is distended. The separation is continued towards the uterus. As soon as the appendages are loosened and turned up, sponge pressure is used to check bleeding. The pedicle is ligatured as usual, or if possible the cautery is applied. If the appendages on both sides have been removed without rupture and there is little bleeding, a drainage tube is not necessary. Should the tube or ovary on either side rupture, in a case where there has not been room to surround the part with sponges large enough to take up all the fluid, the pelvis must be sponged out at once and the rent closed with forceps. When the appendages on one side are diseased, those on the other must also be removed, if they do not appear to be absolutely normal.

When the presence of pus is suspected, great care must be taken to avoid rupture, and unless the walls are very thick it is better to aspirate than to run that risk. Should this accident occur, the pus is to be at once removed, and warm water is to be poured into the pelvis and sponged up; this is to be done several times, and it is better than flushing the general cavity of the abdomen. Such a case must be drained.

CHAPTER IV.

FIBROID TUMOURS OF THE UTERUS.

The removal of a fibroid tumour of the uterus or uterine myoma was the natural outcome of the operation of ovariotomy, and strangely enough, it appears also to have been first intentionally performed by an American surgeon, Dr. Kimball of Lowell, Mass., in 1855. It is only within the last fifteen years that the operation has become a common one; before that time it was performed occasionally, sometimes in mistake for an ovarian tumour, and sometimes after a correct diagnosis had been made. The operation for the removal of the uterus with a fibroid tumour is called hysterectomy, though this name is also used to signify the removal of the uterus for any cause. It can never be compared with ovariotomy, for in the former the disease itself seldom shortens life, though it may, and often does, give rise to much illness and misery; while in the latter a painful death is the natural end if the tumour be not removed. The operation of hysterectomy is a dangerous one, and it is therefore necessary that there should be no doubt that the symptoms which the tumour gives rise to are sufficient to make the patient's life wretched and miserable.

The life of a fibroid tumour is limited, it rarely commences before puberty, and seldom grows after the menopause. The age of the patient ought therefore to influence us greatly in the treatment to be advised. The most common year for the menopause under ordinary circumstances is perhaps the forty-

sixth year. It is later in a woman with a fibroid which does not bleed, usually from the forty-sixth to the forty-ninth year. When there is menorrhagia the change of life is usually from the fiftieth to the fifty-fourth year. Occasionally it may even be later. The most active period in the life of one of these tumours is when the menopause is approaching,—"evils, most of all show evil at their departure." The important part which the age plays in influencing us in advising treatment or not lies in this, that a woman at fifty is in a very different position from one at thirty, and what may not be justifiable in the first may be perfectly right in the second. For example, a hysterectomy was performed on a patient forty-nine years of age for a large tumour, the patient justifying the proceeding to a friend by saying that as she was in perfect health she would probably recover. She wanted a neat waist! Had she been thirty, there would have been no doubt as to the necessity for performing the operation.

Clinically there are three varieties of tumour, the hard fibroid, the soft œdematous tumour, and the fibro-cystic growth. The first is by far the most common. It occurs either in the wall of the uterus itself, intramural; or as a pediculated outgrowth, sub-peritoneal; or as a tumour projecting more or less into the uterine cavity, submucous; but this last variety ought seldom to come within the range of abdominal surgery.

A pediculated outgrowth seldom gives rise to symptoms justifying its removal; and though these operations are sometimes included in the statistics of hysterectomy they ought not to come under this heading.

The soft œdematous tumours, when there are no cysts, but simply a general honeycomb structure, do not always cease to grow after the change of life, and an operation may in such a case be the right thing, even in a woman well up in years.

Symptoms.—The symptoms caused by an ordinary hard uterine myoma are very varied. The growth is slow, and a patient will frequently know that she has had a swelling for

five or ten years before she first seeks advice. The rate of increase is steady, though sometimes these tumours may increase in size with great rapidity; and at other times they may diminish, or cases have even been known of their entire disappearance before the menopause has been reached. These tumours are very common, and in many cases they do not give rise to any symptoms, and even when of considerable size may be discovered accidentally. When they give trouble, the most common symptom for which treatment is required is menorrhagia, occurring at any time. This may vary from a slight hæmorrhage to a flooding of most alarming character. The best way to find out the quantity of blood lost is to inquire how many napkins are required during the period, and how many were required before the patient began to lose too much. This naturally gives only the relative amount of hæmorrhage. In health, a fair average may be taken at from five to eight diapers, and a woman who has used about this number while well may require one hundred or more; a case has been met with where over three hundred were used. The flow may come in sudden gushes, and this is the most distressing way, or the periods may go on to two or three weeks, leaving but one week clear.

A second common symptom is pain or discomfort, this may be in the tumour itself, or in distant parts, and is caused by its pressure. A mass of tumour in the pelvis may cause obstruction to the passage of fæces, or pain on defæcation; or the function of the bladder may be interfered with, there being frequency in passing water, or difficulty or total retention. There may possibly be pressure on one or both ureters. With enormous tumours there may be difficulty in getting about, and also distress in breathing. Œdema of the lower limbs is sometimes seen, but is not so common as with ovarian tumours. Usually a woman with one of these tumours gets stout all over, especially about the chest, and the face is florid unless the loss of blood be excessive.

Local Examination.

On examination of the abdomen the tumour is usually found to be central, even when quite small, and in this it differs from an ovarian growth. It is hard, solid, and does not fluctuate at any part ; it may be quite smooth and regular in outline, or it may be covered more or less with irregular nodules. The umbilicus is drawn in.

On vaginal examination the condition will depend very much on the exact relation of the tumour to the uterus. Should the growth be situated in or growing from the fundus, the cervix and the part of the uterus felt from the vagina may appear to be perfectly normal. On moving the abdominal part of the tumour while the finger rests on the cervix a distinct connection between the two will be made out—pressure upwards perhaps drawing the cervix quite out of reach ; lateral pressure from the abdomen will also markedly affect the cervix ; downward pressure of course gives no information. It is customary to pass a sound for the purpose of diagnosis. This is of doubtful value, as it may lead to many fallacies. In some cases the uterine cavity is not enlarged, while in others where there is a long cavity, the sound may stop at some obstruction and make it appear as if the length were normal. Undoubtedly, when it can be passed to a great depth, it is probable that the case is one of fibroid tumour ; but even here we may be mistaken by having passed it into an elongated uterus drawn up on an ovarian tumour. Should the instrument be used, the short sound of Matthews Duncan is much to be preferred to the long heavy one of Simpson.

If the tumour, instead of growing from the fundus, is situated more or less in the uterine wall, the pelvic examination may reveal many varied conditions. The cervix may be natural, it may be too large, or it may have entirely disappeared, an oval or slit-like *os* alone representing it. It may be lying against the perinæum or it may be drawn entirely out of reach of the

examining finger, and may even be felt on abdominal palpation. It may be central, or to one or other side, and the pelvis may be, and often is, full of tumour. Movement of the tumour from the abdomen will determine whether the cervix and pelvic part of the growth move together; the fact of the cervix not being affected when the tumour is moved is against the diagnosis of fibroid.

It is easy to understand how the broad ligament may be opened up by a fibroid tumour; it must happen more or less in every case, unless the growth spring entirely from the fundus uteri, and the explanation is exactly the same as in the case of an intra-ligamentous ovarian tumour.

The upper edges of the opened-up and raised broad ligaments can sometimes be felt from the abdomen; if the ovaries can be felt that is a guide to the condition; when the cervix is pulled well up to one side, and if it be shortened by being drawn into the tumour, and still more if it has entirely disappeared, one will expect that much enucleation will be required.

The soft œdematous fibroids occur more frequently in young women, they grow more rapidly than the hard variety, are much less common, and may be accompanied by a watery flow, which either discharges itself by the vagina or passes into the peritoneal cavity. When there is this discharge the only treatment is to remove the growth. In other respects they do not differ from the hard tumours as regards their treatment.

Fibro-cystic tumours of the uterus are not infrequently mistaken for ovarian tumours, and many of the early operations of hysterectomy were begun with the intention of removing such a tumour. The growth is comparatively rapid, there may be emaciation of the upper part of the body, the umbilicus is flattened out, there is frequently no menorrhagia, fluctuation may be very distinct, and when there is nothing to be felt in the pelvis the diagnosis is very difficult. These tumours may be divided into two varieties, the one where there is a general honeycomb condition with perhaps one or more large spaces;

and the other where there is one cavity with thick walls. On aspirating the first of these, the fluid comes away not in a continuous stream, but in jerks; in colour it is a pale yellow, and it coagulates spontaneously even without the admixture of any blood. In the other variety the fluid removed may be of a dark brown colour, may not coagulate, and under the microscope it shows evidence of broken-down cells and débris. The fluid in the first case reaccumulates rapidly; in the second, where the condition may be described as one of degeneration, a second aspiration may not be required for a number of years.

A lady fifty-eight years of age was seen in consultation in 1887, in regard to the question of Apostoli's treatment. She had known of the presence of a tumour for years. The abdomen was much distended, and fluctuation could be made out on deep pressure. The fluid was drawn off by aspiration, the trocar passed through at least two inches of tumour substance, and over twelve imperial pints of dark brown fluid were removed. The sac did not fill up for over four years, when it was again aspirated.

Treatment.—The treatment will depend on the gravity of the symptoms, on the size of the tumour, and on the age of the patient. When one of these tumours is discovered in a woman well up in years, the near approach of the menopause, which unfortunately comes late, is looked forward to as an almost certain end to her trouble; but relief does not come immediately. Indeed, the pain and discomfort are at first augmented, for the tumour continues to fill up with blood, and misses the relief afforded by the monthly losses. This stage of increased discomfort may continue from six months to two years after the last appearance of menstruation. Such patients do not require any active treatment unless there be symptoms of extreme gravity.

It is little comfort for a patient of thirty or thirty-five years of age, especially when there are troublesome symptoms, to be told that in fifteen or twenty years she will be quite well;

and treatment which would be absolutely unjustifiable at the age of fifty may be absolutely necessary at the age of thirty.

While judging of the severity of the symptoms, the age must always be borne in mind. Treatment is most commonly required to lessen hæmorrhage, to ease pain, or sometimes simply on account of the size of the growth.

There is considerable choice in the treatment; it varies from rest at the menstrual periods, diet, medicines, medicinal springs, Apostoli's treatment by galvanism, to curetting, removal of the ovaries, and hysterectomy.

The treatment by rest and diet consists in the patient remaining in bed during the whole of the period, and in the food being light and moderate in quantity. No port wine is to be taken, no burgundy, no beef, no mutton, and in fact all stimulating food must be avoided. Fish, chicken, game, milk, milk puddings, fruit and vegetables, may be taken, and if a stimulant be absolutely required, brandy or whisky and water. A patient with a bleeding fibroid must not be fed up, she should rather live below par. Feed a patient on animal food, and she will bleed worse than she has ever bled before. Medicines will be combined with the rest and diet; of these the chief is ergot, but it must be freshly prepared. Drachm doses of the fluid extract given three times a day, commencing three days before the period is expected, and continued until the worst of the flow is over, will sometimes carry people on for a time. Small doses are not very efficacious. In very rare cases a tumour has been known to disappear under its use. The following case where this occurred is reported in the late Dr. Matthews Duncan's *Clinical Lectures:* "The treatment of this case was not to produce absorption; it may be hoped for in an old woman. The treatment adopted was a course of ergot. In many cases this drug is of no avail, but in this case it had results so immediate as to cause astonishment. I must remind you that the tumour was so soft as to give the idea of fluid; this is exactly the kind which

is known to be most benefited by ergot. We injected three grains of ergotine underneath the skin; this was repeated several times at intervals of a day; but it had at length to be discontinued because it produced very serious diffuse inflammation of the cellular tissue, narrowly and fortunately without a suppurative termination. This effect we found to be peculiar to the patient, for the same injection caused no inflammation in several other women, the same syringe and solution being employed. In place of it a fluid drachm of the fluid extract of ergot was given daily by the mouth. The result of the treatment has, as far as I know, never been surpassed as regards rapidity of diminution of the tumour. The dulness which extended one inch above the umbilicus was in forty-eight hours reduced so as to extend only to the level of three inches below it. Such a remarkable and rare result could only have been produced in a soft tumour.

"This improvement was accompanied by arrest of bleeding. After being in the hospital two months she went out, having lost the puffy anæmic appearance, and having acquired a healthy aspect. (Years afterwards she was heard of, and fully maintained all the improvement.)"

Hydrastis Canadensis is at times a useful remedy for checking hæmorrhage, and Hamamelis Virginica is occasionally of service. Of other drugs, digitalis given in suitable cases is the only one which appears to be of much use. The general health must be taken care of, and iron tonics must be given in moderation. Œdematous tumours and fibro-cysts can be reduced by free purgation, and the reduction in size sometimes lasts for a considerable time.

It is doubtful if medicinal springs such as Kreuznach and Woodhall Spa are of much use in the treatment of these tumours. The change and the different mode of life undoubtedly make a patient feel better for a time, but the waters have probably little to do with the improvement.

Treatment by Electricity.—The treatment of fibroid tumours of

the uterus by electricity is a very old method ; it has been tried over and over again, but always in an ignorant and happy-go-lucky manner, until Dr. Apostoli of Paris put the treatment on a definite and scientific basis. Dr. Apostoli had received much information on this subject from Dr. Tripier ; still, the treatment was very imperfect until Apostoli worked it out. The great aim of this treatment by electricity is to stop the growth of a fibroid tumour, and at the same time to cure any symptoms the tumour may be giving rise to. There is also a certain amount of reduction in the size of the growths ; and in the case of small tumours, they may even disappear entirely, leaving the patient in a perfectly healthy and natural condition. This can be done without any risk to life and without the assistance of any other treatment ; the patient need not rest, she can take what food she pleases, and can take iron with impunity. Operations, when no special difficulties are expected, are now so safe that the question of safety alone would not be sufficient to make one advise electricity rather than an easy operation ; but, putting out of account the palliative operation of curetting, an operation means a serious mutilation. In a woman of forty or forty-five this mutilation is of little importance, but in a young woman it may influence in a very marked way the rest of her life.

The apparatus for the proper carrying out of Dr. Apostoli's treatment is not very complicated, and a knowledge of electricity beyond the very rudiments, though advisable, is not essential. A battery is required which will be of sufficient strength to pass a current of two or three hundred milliampères through a patient. In the choice of a battery two points have to be borne in mind: the amount of force which can be got out of the battery, called the electro-motive force; and the amount of resistance which this electro-motive force has to overcome in the cells themselves—the internal resistance; and in the wires, patient, etc., outside the battery—the external resistance. This brings us to the only electrical law we have to pay heed to, viz. Ohm's Law. The law is, "the current equals the electro-motive

force divided by the sum of the resistances." This described symbolically is

$$\text{Current (C)} = \frac{\text{Electro-motive force (E.M.F.)}}{\text{Internal and external resistance (R + R')}}.$$

The unit of current is called an ampère; in medicine and surgery this unit is divided into thousandths, and they are called milliampères. The unit of electro-motive force is called a volt, and the unit of resistance an ohm. In the selection of a battery we will require to know what is the electro-motive force of the cells composing it, the resistance to the passage of a current of electricity in the cells themselves, and also the resistance to be overcome outside the battery, *i.e.* the amount of work to be done. For home work thirty or forty large (quart) Leclanché cells make a battery which gives sufficient electro-motive force, and which at the same time gives the least possible amount of trouble, and requires least attention. The electro-motive force of a Leclanché cell may be roughly taken at 1·5 volts, and the internal resistance of the quart size of cell at ·5 ohm. If thirty such cells be joined together in series, *i.e.* the carbon of one to the zinc of another and so on, until there is at one end a free carbon, the positive pole, and at the other a free zinc, the negative pole, the electro-motive force of the whole will be 45 volts, and the internal resistance 15 ohms; thus $\frac{\text{E.M.F.} = 45}{\text{R} = 15} = 3$ ampères or 3000 milliampères. This would be the amount of current obtainable from such a battery, if there were no external resistance to be overcome. This external resistance is in the wires, instruments, and chiefly in the patient herself. When Dr. Apostoli's directions are carried out, the total sum of external resistance will probably never exceed 150 ohms. We shall thus have $\frac{\text{E.M.F.} = 45}{\text{R} = 15 + \text{R}' = 150} = 272$ milliampères. This amount of current will be of this strength only when the cells are freshly charged and in perfect working order. At the end of six months of daily use the cells will have to be cleaned and recharged with the sal ammoniac solution, as the battery will have lost some-

what in strength; or a more simple plan is to add some additional solution to each cell, and so increase the power of the battery. By doing this a battery of large Leclanché cells may be used every day for a year without requiring to be recharged. The battery, once it is in working order, requires attention only in two matters; the watery solution of sal ammoniac evaporates and has to be added to occasionally, and after a time the zinc elements are destroyed and have to be renewed. With these attentions a Leclanché battery will last for at least seven years without the porous pots containing the carbon and binoxide of manganese having to be renewed. The battery is to be kept in a cool place, and a couple of well-insulated wires are to be brought into the consulting-room, one from the positive, and the other from the negative end of the battery.

One essential part of the apparatus for use with a battery arranged in this way is a rheostat. This instrument is for the purpose of gradually increasing and as gradually diminishing the current; its principle consists in the introduction into the circuit of such an amount of resistance that the electro-motive force of the battery cannot overcome it. This resistance is gradually taken out, and as the amount is reduced the electrical current begins to flow. The strength of the current is lessened by reversing the action, and again putting in the resistance. By this means all jerk or jar is avoided. In the batteries usually sold the arrangement is somewhat different; two wires are taken from each cell to a disc, and when the current is increased it is done by means of a handle which is passed on from one of those discs to another. When the handle is at No. 1, one cell is included in the circuit, when at No. 2, two and so on. The disadvantages of this arrangement are, that when there are so many wires, some may easily get broken; and that some patients feel a shock or jar when each cell is added to the circuit. Various forms of rheostats are used, the best one we have tried is the graphite instrument of Dr. Lewandowski of Vienna.

For scientific purposes a galvanometer is required to measure the strength of the current. Without this instrument it is impossible to tell what dose of electricity a patient is taking; and, although the sensation of the patient is the guide we must always go by in regulating the dose, still it is satisfactory to know the strength of current so as to be able to compare one day with another and one patient with another. Several instruments are made for this purpose, and any one which registers correctly will do. For convenience a current changer or commutator is to be added to the list of apparatus.

A useful portable battery will be found to be one composed of modified Marie Davey cells. They are made with a collector attached to them, and the current can be increased by using it, or if it be desired to use the rheostat the full strength is used, and the rheostat regulates the dose.

So much for the apparatus. We now come to the method of application. The electrical current has to be passed through the tumour, and as the body resistance lies chiefly in the skin, it is necessary to reduce that resistance, as otherwise the skin would be destroyed. This is to be done by spreading the current over a large surface, so that little electricity enters at any one spot. The best material for making this external or skin electrode is modelling clay; a pad is made of this, nine inches by seven and three quarters of an inch in thickness. The clay is kept together by a piece of muslin, and a sheet of block tin with an insulated wire attached is laid on the surface. The advantages of the clay pad are, that it can be applied closely to the skin, and it is a good conductor of electricity; the disadvantages are, that it is cold and heavy. It is also said to be dirty, but should any adhere to the clothes it can be easily brushed off. In spite of these disadvantages the clay pad is better than any other. With its use, and when it is of proper size, all burning of the skin is avoided. Apostoli's internal electrode consists of a platinum sound which is inserted into a hollow handle, and can be projected to any length. The vaginal

portion of the sound is protected by a sheath of celluloid, and by this means any length of platinum can be exposed in the uterus. To those who are accustomed to use a short sound, the same principle can be carried out by having several of the shape of Matthews Duncan's ordinary uterine instrument, made with platinum points, the stem being covered with vulcanite.

In the treatment of a bleeding fibroid it is best, when the patient can bear a fair dose, say 130 milliampères, and when the cavity is not enormous, to have the platinum long enough to extend from the internal os to the fundus. During the application the sound is passed slowly, and with as much pressure as the patient can bear, over the whole of the uterine mucous membrane. In this way the soft fungous surface of the membrane is destroyed. When the dose is small or the cavity very large, we must content ourselves with going over only a part at one time. It may happen that a sound cannot be introduced into the uterus; if in such a case there be a part of the tumour within reach of the finger, a shallow puncture is made through the vagina into the growth. These punctures should always

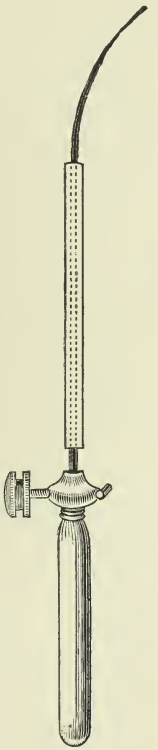

Fig. 29.
Apostoli's Sound.
(One-third size.)

Fig. 30.
Keith's Sound.
(One-half size.)

be made behind the cervix and at a spot where no pulsation is felt. The depth must never exceed half an inch, and may be even less. Before passing a sound or making a puncture, the vagina must be thoroughly purified by being syringed out with a strong solution of perchloride of mercury. This is a precaution which must under no circumstances whatsoever be omitted. Should this not be done, the operator has only himself to blame, if any trouble result. After the application is over, the vagina must be again syringed out; and when a puncture has been made a pad of antiseptic gauze must be placed against the spot. In all the hæmorrhagic cases, and in the majority of others, the positive pole is to be used inside the uterus. The negative must always be employed with caution, especially in delicate women. It reduces the size of a tumour more quickly than the positive, and is generally used when punctures are made, or when the tumour is giving rise to pressure symptoms.

There must always be a certain amount of local action, and this is of use in the bleeding cases, as the chemical cauterisation destroys the bleeding surface. The chief action appears to be a more general one, it consists in a lessening of the circulation of the tumour, and is accompanied by a partial starvation and consequent atrophy of the growth. Each application lasts for five minutes, and there does not appear to be much, if any, advantage in allowing the current to flow for a longer time. The sittings may be repeated every second day.

It is not necessary for the applications to be made while the patient is in bed; unless she be very weak she can come to the surgeon's house. After the application she may wish to rest for half an hour or so, but many prefer to go home at once. On the day of the application she must keep quiet, no dinner party or theatre. The day after she can do much as usual, but the more delicate people rest the more quickly they improve. It is not uncommon for a patient to say, "I cannot come next day, as I am going out to dinner."

When the patient is very weak it is better to carry out the treatment in her own home and in her own bed.

The first effect is often a depressing one; for five or six applications the patient may feel disturbed, after that, and if too many applications are not made, the treatment has a tonic effect, some patients feeling as if they had had a glass of champagne. The number of applications will vary with the strength of current the patient has been able to bear, and also with the age of the tumour; the older the growth, the slower the progress. As a general rule it will be found that thirty applications will be required. Should the patient be able to bear but a small dose, 40 milliampères or less, we may feel certain that the growth is not a uterine fibroid, or that there is some co-existing disease in the pelvis, probably of an inflammatory nature. The great advantage of the treatment by electricity is the avoidance of all mutilation and the absence of risk to life. Mutilation is placed first, because, as will be seen when the consideration of the operative treatment of these tumours is reached, the risk to life following one of the two major operations is very little. No young woman will willingly allow her ovaries to be sacrificed, if she be made really to understand what the operation means, and if the hope of a cure can be held out to her without this mutilation. It is not sufficient to say that the ovaries will have to be removed, without explaining that their removal means the stoppage of menstruation, and the impossibility of bearing children. The disease under consideration is not a disease of the ovaries. It is one thing to remove ovaries diseased in themselves, and quite another to remove healthy glands for the purpose of curing disease elsewhere.

A lesser advantage is, that the patient does not require to be confined to bed, even for a single day, during the treatment. A nurse is not required, and the bedroom need not be turned into a sick-room. The patient has no anxiety, the friends are not alarmed, and the whole excitement and general disturbance

entailed by an operation is avoided. The chief disadvantage is, that except in the case of small tumours the growths do not entirely disappear. Small tumours, and by small are meant those which do not rise much out of the pelvis as a rule, are completely dissipated; and when this result is obtained nothing could be more satisfactory, the patient being restored to health a sound and whole woman.

In a larger growth the symptoms disappear, the tumour is reduced in size, and its future increase arrested. A second disadvantage is that the treatment will usually extend over three months. This is perhaps not a very great drawback when the patient does not live at a distance, an hour's journey being of no particular moment; but when she has to leave home for three months the question of time becomes of considerable importance.

A third disadvantage, and perhaps the most important of all, lies in the fact that with our present knowledge it is not possible to say when the patient is cured; all that can be done is to make an average number of applications and warn the patient that a second course of treatment may be necessary, though this is seldom required. Sometimes six months even may elapse after the treatment is over before the patient can say she is quite well.

When large tumours of 20 lbs. and upwards are treated it is best to give half of the applications at one time, and the remainder six or twelve months afterwards. In such cases it may be even necessary to repeat the treatment at intervals, in order to carry the patient on till the menopause. In these large tumours this treatment is recommended only if the patient be near the menopause, or if operation be impossible or is declined.

When a patient is so far spent that time is of importance, it is advisable to make the applications every second day whether bleeding is going on or not.

The menopause seems to come sooner, after this treatment has been gone through, than would naturally be expected.

One or two precautions which have been learned by experience may be given. The treatment ought not to be a painful one, and should much suffering be caused it is certain that Dr. Apostoli's directions are not being carried out. The directions to be given to the patient are, that the strength of the dose must not be great enough to cause internal pain, and that if she suffers it is her own fault for not at once mentioning it. The reason why internal pain must not be allowed is that such treatment is not free from danger, and even if it should not do harm, the difference in the strength of the current which gives comparative comfort and that which causes actual pain is so small, that the slight good cannot balance the five minutes' suffering.

An application should not be made on any day when the patient is feeling out of sorts, especially if she be in the slightest degree feverish. The following are examples of how this treatment is carried out:—

A patient forty-five years of age was sent to Edinburgh from Inverness by her doctor for operation in the month of June 1887. She was probably the first patient treated by Apostoli's method in Great Britain. The lady and her husband were willing to do anything to avoid the risk and anxiety of an operation, even to be experimented upon so far at least as to be the first case. The history was that she had never been pregnant, and up to the age of forty had enjoyed good health; the periods were regular and were not in excess. Between the ages of forty and forty-one there was a change. The time the flow lasted began to be prolonged, and the quantity of blood lost steadily increased. Keeping pace with this the general health began to suffer; she became breathless and anæmic; the periods continued for about two weeks, and returned sometimes after an interval of one week, sometimes after an interval of two weeks, but she was never dry for longer than two. She had to remain in bed for at least one, and sometimes for two weeks at a time, or, in other words, from three to six months in the year. While lying

in bed she was afraid to do anything for herself, as even the simple raising of the arms above the head caused a sudden rush of blood from the womb. After the period she was unable to walk upstairs without assistance. When the bleedings began to be severe she took ergot in large quantities with marked benefit for a time. Latterly, however, it had ceased to be of service, except that she thought that the bleeding would have been worse had the drug not been taken. About the beginning of the year the tumour was first noticed.

The patient was very anæmic and breathless, and on examination the tumour was found to extend to fully three inches above the pubes. The cervix was situated far back, and there was some difficulty in passing a sound to a depth of three and three quarter inches. It was evident that this was a case for the use of the positive pole in the uterine cavity.

The treatment was begun in June 1887, and, fortified by what we had seen at Dr. Apostoli's clinic in Paris, the patient was allowed to walk home to her apartments, a distance of perhaps three hundred yards. Next day she was found to be none the worse, and a slight bloody discharge had stopped.

The period came on at the end of the month and was much as usual. The second did not appear until twenty-six days after the first had stopped, the longest interval for more than three years, and the quantity was much lessened. The patient went home nine weeks after the commencement of the treatment, after twenty-one applications, averaging less than 100 milliampères, each application having lasted for from five to ten minutes. The following letters show the after results:—

"17th November 1887.—I beg to inform you that Mrs. R. has passed through another of her periods, which was longer in duration than the two former ones, although accompanied by less hæmorrhage. It commenced on Sunday the 5th, and was scarcely noticeable for three or four days, after that it was more perceptible until the 15th, when it vanished. The last two days

there was very little. She did not go to bed through the day, and feels quite strong now."

"22nd December 1887.—I am glad to say that your treatment has made her like another person."

"27th January 1888.—I am happy to inform you that Mrs. R. has just passed through another of her monthly periods very easily, something similar to what used to be previous to her tumour affliction. She had not to go to bed through the day, and now feels quite strong."

"27th August 1888.—Mrs R. desires me to acknowledge the receipt of your kind note of inquiry, dated 24th inst., and to thank you very much for your remembrance of her case, and to say that her February period was light; March, April, May, June, and July, scarcely any bleeding; but during her August one a good deal, which was not to be wondered at, seeing there was next to nothing the five previous months."

"7th September.—Mrs R. had arranged to have her photograph taken on Saturday last, the 1st inst., but her September period coming on prevented her. She wished to have a card freshly taken to show you how well she is looking; but this turn has made a very great change on her—she is now white and weak.

"The first day there was not much bleeding; the second there was more; on the third, fourth, and first half of the fifth there was much—very much; but less and less every day since."

"24th October.—Since I last wrote you about Mrs R., her October period has come and gone. She was not nearly so bad this time, although there were five and a half weeks between the October and September ones. Mrs. R. desires me to enclose her photograph, which, I think, will testify to her being in pretty good health."

"21st January 1889.—Since I last wrote you on the 24th October, Mrs. R. has only had one slight—very slight—period, and that on the 17th November; thus nine weeks have passed

without any indication of another. She is in good health and spirits."

It is interesting to note that there is no mention of the condition of the tumour. The tumour itself was evidently considered of no importance as long as it did not give rise to symptoms. A thoroughly sensible view of the case.

In the summer of 1893, the patient called to show herself; she said that she had menstruated fairly regularly for five years after the treatment, and had kept well the whole of that time. She ceased altogether at fifty, and had no trouble at that time.

A second example is the following, a patient forty-four years of age, treated in 1887. The history had indeed been a sad one. She said that she had been to every doctor in Edinburgh, and that no one had been able to do her any good. She had been ailing for fourteen years, or according to her husband for twenty-one, but had been very ill for seven years after catching cold. At that time she was in the early months of pregnancy and had aborted. Since then her business had apparently consisted in trying to get well. She had been an in-patient in the Infirmary under the care of Professor Simpson and the late Dr. Angus MacDonald; and had been in 1885 in the Special Ward for the treatment of ovarian diseases. All of the usual remedies had been tried over and over again, and her recuperative power appeared to be so slight that operation could not be advised, more especially as it seemed probable that it would be difficult, or perhaps impossible, to remove the ovaries. After three months' experience in the use of Dr. Apostoli's method, and being confident that the general tonic effects of the treatment would more than counterbalance any disturbance the passage of a sound might cause, the woman was sent for, and came for treatment on the first day she was able to be out of bed, three weeks after she got the message.

The patient was a thin, dark, sallow woman. On examination of the abdomen an irregular tumour was felt lying against the abdominal wall, and extending to three inches above the pubes.

In the pelvis the cervix was found to be situated far back, and a part of the growth pressed on the bladder. The sound passed to a depth of four and a quarter inches. The patient stated that she had been in constant pain for the last seven years, and for fifteen years there had been a steadily increasing quantity of blood lost at the periods. Before and for the first few days of the menstrual flow the pain was very much aggravated, and prevented her from sleeping. Menstruation now lasts for fourteen days, and recurs after an interval of one week; formerly, its duration was seven days with a twenty-one days' interval. This was a very satisfactory case for the treatment, as there appeared to be a very general consensus of opinion that any operation would be attended by great danger to life.

21st September—40 milliampères for 5 minutes.
23rd „ 50 „ 5 „

Says that she feels stronger already.

3rd October—40 milliampères for 5 minutes.

The period came on ten days ago; the loss of blood was greater than usual, and the patient feels very ill.

5th October—40 milliampères for 5 minutes.

The bleeding stopped after the last application.

12th October—40 milliampères for 5 minutes.
14th „ 70 „ 5 „
17th „ 70 „ 5 „
24th „ 80 „ 5 „

A second period since the treatment was begun is over. It lasted seven days, was not very severe, and there was an interval of two weeks instead of the usual seven days.

28th October—120 milliampères for 5 minutes.

There has been some bleeding for two days.

31st October — 120 milliampères for 5 minutes.
4th November—120 „ 5 „

Feels better and stronger, and looks more cheerful.

18th November—100 milliampères for 5 minutes.

Has been flowing for five days. Feels much better, is stronger, and can walk better, and has little pain.

25th November—135 milliampères for 5 minutes.
28th „ 155 „ 5 „
5th December— 135 „ 5 „

There has been rather more pain.

9th December—100 milliampères for 5 minutes.

The pain is relieved; there has been some hæmorrhage for three days.

12th December— 100 milliampères for 5 minutes.
6th January 1888—160 „ 5 „

Feels well although there has been as great a loss of blood as she has ever had. The general health is undoubtedly much improved.

8th January—160 milliampères for 5 minutes.
23rd „ 145 „ 5 „
30th „ 110 „ 5 „

Flow six days. Does not feel strong.

3rd February—130 milliampères for 5 minutes.

Is feeling better again. The weakness complained of at last visit was probably due to some little stomach derangement.

10th February—135 milliampères for 5 minutes.
13th „ 140 „ 5 „
27th „ 275 „ 5 „

The period on this occasion lasted nine days; there was much less flow and much less pain.

29th February—220 milliampères for 5 minutes.
2nd March— 250 „ 5 „
5th „ 230 „ 5 „

The patient says that she feels quite well to-day, and has not done so for ten years.

9th March—245 milliampères for 5 minutes.
19th „ 270 „ 5 „

There has been less loss during the menstrual period, which is just passed, than there has been for a long time. There was, however, more of the old pain for the first two days.

21st March—220 milliampères for 5 minutes.
23rd „ 225 „ 5 „
26th „ 200 „ 5 „
28th „ 210 „ 5 „
30th „ 235 „ 5 „
31st „ 210 „ 5 „
2nd April— 210 „ 5 „

The internal electrode was, in every one of the thirty-seven applications, attached to the positive pole of the battery.

The patient was afraid that the improvement might not be permanent, but the following extract from a letter, dated 5th February 1889, shows that her alarm was groundless:—"My period now comes once a month and lasts a week. I have pain a day or two before, and rather worse the first day of the period, but nothing to what it was before the electricity. My general health had been bad since the pain began. I have not felt so well for twelve years. After the treatment was stopped I gradually grew stronger, and have never been laid up a day since you left Edinburgh. I am able to walk without pain or discomfort of any kind, and can't feel grateful enough to you for all your kindness."

In the beginning of 1891, the patient was examined and a uterus of normal size, with a two and a half inch cavity, was

found. The patient was perfectly well, and menstruating regularly.

A patient twenty-four years of age gave the following history:—The periods began at fourteen and had been always copious. By degrees the intervals became shorter and the quantity greater. For four years menstruation came every three weeks, and the last went on for twenty-one days without any interval. She was thin, though there was no pain, and she could walk fairly well. In a word, her only complaint was the long continuance of the period and its uncertainty as to quantity —the least excitement increasing the flow. She could not go out with a light dress to a theatre or concert, or out to dinner or any evening amusement, or play tennis in summer. She was debarred from the pleasures of young people, and on the very few occasions she ventured out in a light dress it was almost always soaked through before she got home again. Remedies had been tried without making any change in this condition.

The uterus was large and somewhat fixed. The cervix was very large, and the os admitted the point of the finger. The probe passed with difficulty three and a half inches, and would probably have gone farther if the uterus had not been so fixed. There was no growth inside the cavity. The treatment lasted six weeks, and twenty applications were made. Instead of at most three days' respite, the first interval was three weeks—the longest for four years. The period lasted four days, and was quite moderate; and as the next was also normal, no farther treatment was advised. The uterus was then soft and movable, the cervix was no longer open, the os was small and closed, and the cervix half the size. The uterine cavity was scarcely above two and a half inches in length. Six months afterwards the patient was married, and has since had at least one child.

There is a somewhat unreasonable objection to Dr. Apostoli's treatment, and two examples of this may be given:—A lady suffering from menorrhagia was very strongly urged to submit to the removal of the ovaries, and, after she had been cured by

electricity, and before any signs of the menopause, she was asked by the same gentleman whether she had been cured by time or by Dr. Keith! In the other case, a surgeon attached to one of the large hospitals said to a lady whom he had known six years before when she was in bad health due to symptoms caused by a fibroid tumour, that she was looking very well, and he asked what had done her good. Although he must have known that the lady had been kept in her bed for two years without benefit, and was so ill that hysterectomy had been consented to, yet he said it was "rubbish" when she told him that Apostoli's treatment had cured her. He said that rest had done it! She had not rested either during or after the electrical treatment.

In this connection may be mentioned the remarks made by a medical student speaking in glowing terms of a lecturer who had dismissed the electrical treatment in a few words as being absolutely useless:—"I saw a hysterectomy performed on a patient forty-five years of age where there were almost no symptoms. How any one could have made a diagnosis with so little to go on I cannot imagine." This tumour, causing scarcely a symptom, was about the size of a breakfast cup, yet hysterectomy was performed.

Curetting.

When a patient with a bleeding fibroid has nearly reached the menopause, and when the uterine cavity is not very irregular, nor longer than perhaps five inches, scraping away the soft unhealthy bleeding surface, or curetting, may be sufficient to tide the patient over the menopause with comfort. This slight operation may have to be repeated several times, but it is useless in young women, or when the menopause is likely to be delayed for a number of years. The operation is of the simplest, ether is administered, the patient is placed on the side, and a Sims' speculum is introduced; the vagina is thoroughly washed out with a solution of perchloride of mercury; the cervix is rapidly dilated, Goodell's dilator being better than Hegar's; and the

whole lining surface of the uterus is gone carefully over with a blunt curette,—Martin's will be found a useful instrument. An attempt to examine the interior of the uterus with the finger should be made. This is sometimes not easy, and at other times it is impossible. The cavity is next thoroughly washed out with a hot antiseptic solution introduced at a low pressure, and as much iodoform gauze as the uterus will hold is packed tightly in. The advantage of using the gauze is that any fungosities missed by the curette will be destroyed by pressure. The gauze is to be taken out in twenty-four or forty-eight hours. The patient remains in bed for a week or ten days, and can then go about as usual.

Removal of the Ovaries.

The consideration of the removal of the uterine appendages for the cure of a uterine fibroid opens up the question of what is the cause of menstruation. Until lately the influence of the ovaries was supposed to be the only cause. Later it was suggested that the Fallopian tubes might have something to do with the phenomenon, but this theory appears very properly to have been given up. A third suggestion has been made by Dr. Johnstone of Cincinnati, that the cause is situated in a nerve ganglion which is to be found at each side of the uterus. To say that the nervous system has something to do with the monthly flow is little more than a truism, but at present we do not know of any part of the nervous system, the removal of which will stop menstruation, although it is practically certain that there is a nerve centre in the spinal cord.

The following history excludes the idea that the origin of menstruation lies in these ganglia on each side of the uterus, for it will be seen that the case is one on which the theory was principally built up, and the removal of the ganglia did not stop the monthly discharges :—

In March 1890, Dr. Keith was asked to see a young lady, who was then residing in Bournemouth, and who sent the

following history of her case:—"My illness first began ten years ago. I had a swelling every month in my right side. I went to Scotland, and walked a great deal, and swam every day in the sea. Suddenly a bad pain came on in the back of my leg, just opposite to where I had the swelling in front. My monthly time would never come on, except I put mustard poultices on the back of my leg. I had this pain for more than two years. The doctors thought it was sciatica. I had electricity and two steam baths a day. When I was in my bath my pain was better. I was three months at the Turkish baths, the pain returned directly I stopped having them. A pessary with a stem was introduced, and I was told that I need not take any care of myself, that I might even ride; a fortnight afterwards I went to the North of Scotland; inflammation set in; the pain, instead of only being at the back of my leg, began also to come into the front. I became sick, and had to send for a doctor, and he said that the pessary had fallen out, I was obliged to have leeches on. I managed to get to Edinburgh, where Dr. Angus MacDonald attended me, and on examining me he said that my inside was like a boggy mass. He painted me with iodine, and I had also iodine injections, and was burnt at the back of my leg. At last I had an operation; Dr. MacDonald took away my left ovary, but, although he hunted for an hour, and told me I had been very roughly handled in the search, he could not find the right ovary. The next month, my monthly period came on again, and the pain in the back of my leg was as bad as ever. At last Dr. MacDonald told me that he had just seen Mr. Lawson Tait, and he was of the opinion that they might have another try to find the missing ovary; but before the operation could be attempted, Dr. Angus MacDonald died. I then went to Mr. Tait. He operated again and took away the uterus, as he said there was an incipient tumour in it. At first we did not know that he had not found the ovary, but in reply to a direct question, he admitted it, and said it must be virtually destroyed, and would not affect me in

any way. A month afterwards my monthly period came again, however, and I could never raise my right leg without bringing on a great deal of pain in my right side. I went to Mr. Tait, but he said that I was all right, and must amuse myself as much as possible. I went to the Riviera, and was a little better there, if I kept very warm and did not walk. Subsequently we went for a year to India, and the improvement was much more marked, though still I could not walk or raise my right leg without pain. For a month I even attempted riding and playing tennis, but had to give these up, as at my monthly times they brought on strong irritation, although all the doctors had told me I might take any exercise I liked. If I kept quiet, I never suffered at all from my monthly periods while I was in India. Suddenly we were obliged to return to England, and since then I have scarcely been out of bed. I have usually a severe attack of three weeks' duration nearly every month, and besides the ovary the stump of the uterus now gives me constant pain. I was five months in bed last winter and expect to be so again. During the summer the pain is not quite so bad. It is now four years last March since my last operation, and my monthly times still continue, but in England a very small quantity comes from me, and that is as thick as glue." In a letter from the sister about the patient coming to town she said, "It is her monthly period at present, so she could not travel for another ten days." The continuation of the history is taken from Mr. Tait's book on *Diseases of Women and Abdominal Surgery*:—

"When the ovary of one side (or of both) has not been developed, the uterus being normal, a curious condition is met with, which I have not yet seen described, but which I have often seen in operating. From the uterine cornua the tubes depart in a normal condition of size, direction, and relation to other structures. But before they have gone far the folds of the broad ligament separate, it gets lowered and flattened, and it finally gets lost in the walls of the pelvis. The tube (or tubes)

is lost in the ordinary widening of the broad ligament, and no ovary (or ovaries) is to be found.

"In the great bulk of such cases it is reasonable to suppose that no trouble exists save sterility in such as have married. But in some cases the sufferings are so great as to call for surgical interference, and a typical case of this kind was placed under my care, as almost the last act of his life, by my lamented friend, the late Dr. Angus MacDonald of Edinburgh. The details of this case possess such extreme interest that I must give them in full.

"I communicated with her, and had a long letter from the patient's mother, giving a lamentable account of her sufferings. The patient was entirely unable to walk, could not even be driven in a carriage without intense pain, and when I saw her every feature of her face confirmed a belief in the reality of her sufferings. These had without doubt been increased by the incomplete operation in the previous September. I visited the patient at Clifton on the 14th of March 1886, and arrived at once at the conclusion that nothing short of the removal of the body of the uterus would be of any avail. I found that the patient's symptoms had been added to by a fresh complication of menorrhagia, that since the operation in September the amount of monthly loss had been increased, and with it her sufferings had been intensified. On examination it was quite evident that the fundus of the uterus was very large, and was pulled down to the left side. I reopened the abdomen and found the condition as Dr. Angus MacDonald had told me. A puckered spot on the left broad ligament, from which he had removed the uterine appendages, was perfectly apparent, and no trace of ligature could be discovered. On the right side the tube could be felt on the cornu of the uterus, going into the broad ligament, and then the broad ligament opened out and was flattened downwards, and was lost in the wall of the pelvis. No trace of any ovary could be discovered on that side at all. I pulled the uterus well out of the wound, dissected out from the incomplete

broad ligament the Fallopian tube as far as it could be felt, and then separated the body of the uterus from its secondary textures. I passed a ligature through it, well down towards the cervix, and tied it by the Staffordshire knot, and then cut away at least two-thirds of the organ. The patient made an easy recovery. In the wall of the uterus I found a small myoma, not much bigger than a filbert nut. The growth of this after the first operation is remarkable, and no doubt its presence explained the increased suffering and the increased menorrhagia. The Fallopian tube on the right side was found on the cornu of the uterus, perfectly normal in appearance and structure ; then, as I have already said, it became lost in the cellular tissue of the broad ligament.

"The subsequent convalescence of the patient was extremely slow, for at the end of the year, after several months' residence in the Riviera, she had made much less progress than I had anticipated. She was able to walk (which she had not done for many months before the operation), but not for more than ten minutes at a time. She suffered intensely from cold, her mother said her circulation was extremely bad, and that she literally was never warm. She got an idea that she would like to go to India, where she had a brother, and with this proposal I quite agreed. Up to this time there was still an appearance of menstruation, but irregularly, more scanty, and relatively devoid of pain. She has now excellent health, and is able to play lawn-tennis. Menstruation has entirely ceased, and she is quite free from pain."

The following is an extract from Dr. Arthur Johnstone's paper as reported in Mr. Tait's book, and it shows very clearly that the removal of these plexus did not in this case at least stop the menstruation :—

"This led me to study more closely the sympathetic plexus of the broad ligament, and I found that, besides quite a large amount of filaments, which accompany the Fallopian tube and the uterine branch of the spermatic artery, there is one

particularly large trunk which comes up at a very acute angle to the body from deep down in the base of the broad ligament, and enters the uterine cornu just underneath the angle of the Fallopian tube. This nerve lies so close to the body that, if the operator is not extremely careful to extirpate the whole of the Fallopian tube, he is very apt to miss it. This I believe is the track through which the endometrium receives its physiological orders, and that section of this nerve does for the endometrium exactly what the section of the chorda tympani does for the submaxillary gland.

"I saw, in connection with Mr. Tait, another striking case in support of this idea. The attempt at an artificial menopause had been made by an Edinburgh surgeon, but the patient came with the report that only *one* tube and ovary could be removed.

"At the second operation no trace could be found of anything that looked like a tube or ovary on the right side. As she had been made desperate by her sufferings, she urged on Mr. Tait the necessity of relief at any risk, and he accordingly removed the uterus at the internal os. I took the specimen, and after carefully freezing it, and examining every section from the margin of the endometrium to the peritoneal periphery, the only attempt at a Fallopian tube I could find was a slightly exaggerated development of the uterine follicles in the right cornu. Although she had one or two slight attempts at menstruation, she subsequently quieted down, and got permanent relief from her old trouble.

"The first operation had completely isolated the endometrium from its nerve supply on the left side, but, in spite of the fact that the tube and ovary on the right side had never been developed, still the nerve plexus kept up its control of the endometrium until completely severed by the second operation. Thus I think that we will be safe in saying that it is not the removal of the ovary, or the removal of the tube itself, that brings on the change of life, but that it is the neurotomy which the ablation of these organs necessitates which completely

isolates the endometrium, and leaves it like the lower limb after the section of the great sciatic."

The lady was seen on 22nd April 1890. She was emaciated to an extreme degree, the pulse was rapid, she looked forty or forty-five instead of twenty-nine years, and looked as if she were in constant pain. In every way she was worse since the operation on the uterus, and whenever she got the slightest chill the pain in that organ was terrible, and was accompanied by persistent vomiting. On going carefully into the history, there could not be a doubt about the presence of the right ovary; the statements were so exact that there had never been any pain in the region of the uterus until after Mr. Tait's operation, and the fact of the continuance of menstruation made this certain. On examination the uterus was found to be somewhat fixed and drawn to the left, the uterine cavity measured slightly over two inches, and the ovary could not be felt. It was to be expected that after Drs. MacDonald and Tait had both failed to find the ovary, it would be discovered in some abnormal position, and from the patient's description it was concluded that it was probably lying in the sciatic notch. On writing to Sir William Turner, he told us that the account of an ovary being found in this situation was to be obtained in Camper's *Demonstrations,* and here we found it described.

A few days after coming to town the lady had one of her "chills," accompanied by vomiting and excruciating agony in the position of the uterus. She became so much reduced that an operation hardly seemed possible. After waiting seven weeks to allow of a slight recovery the operation was performed. Expecting a difficult operation, a three inch incision was made, the fingers were passed at once into the sciatic notch and over the whole side of the pelvis; there did not appear to be a particle of fat anywhere, but the ovary was not found. The uterus to which the omentum was adherent was drawn over towards the left side. Not finding the ovary below its natural position, it was felt for higher up and was

immediately discovered. It was enlarged, non-adherent, and was removed along with an inch of the outer end of the Fallopian tube. Its weight was found to be 295 grains. The operation lasted twelve minutes, and it was fortunate that it was so simple, as the patient would probably have died on the table had it been much longer. Menstruation has never recurred, the original ovarian pain is gone, but the uterine pain, which first appeared after Mr. Tait's operation, is still at times troublesome, and has prevented the patient regaining her strength.

The ovarian theory of menstruation plus a centre in the spinal cord somewhere is still the best. Patients have undoubtedly menstruated regularly after the removal of both ovaries, but the fact that both these glands have apparently been removed is not a guarantee that no ovarian tissue has been left.

The practical outcome—and it is this that is of importance to the patient—is, that the ovaries and as much of the broad ligament as possible, including the Fallopian tubes, are to be removed. There is no harm done by taking away too much, the fault is in removing too little.

The necessity of removing the whole of the Fallopian tubes is well seen in the following case :—In the beginning of 1893 a lady thirty-three years of age was operated on, who gave the following history. Three years before, the left tube and ovary had been removed for persistent pain in the left side by an accomplished abdominal surgeon. Improvement did not follow the operation, and when seen the pain was situated not only on the left side but also in the right. Examination revealed an ovary enlarged to fully four times its natural size on the right side, and on the left projecting from the side of the uterus an exquisitely tender nodule the size of the tip of the forefinger could be felt. When the second operation was performed this nodule was found to be the closed end of the Fallopian tube, which when removed was found to contain a few drops of sero-purulent fluid.

The operation of the removal of the ovaries for the purpose

of bringing about an artificial menopause, and in this way curing the symptoms caused by the presence of a uterine fibroid, was first performed by Dr. Trenholme of Montreal. The field for this operation is limited by the size of the tumour, by its exact nature, and by the position of the ovaries in relation to the tumour. When the uterine growth extends much above the umbilicus, the effect of the removal of the ovaries does not appear to be beneficial. Soft œdematous tumours, and those also where there is ascitic fluid or when there is a profuse leucorrhœa, cannot be cured by this operation with certainty. In a certain number of cases, the ovaries are placed so close to the tumour or even may be so incorporated with the capsule, that it is not possible to remove them without injury to the uterine growth.

The ultimate result of the complete removal of the ovaries in small tumours is extremely beneficial. The symptoms are cured, the growth is arrested, and in a considerable number of cases the uterus gradually returns to its natural size. This reduction may occur with great rapidity, sometimes accompanied by a profuse watery discharge, or it may take six months or a year. In our experience there is always a certain amount of reduction in the size of a fibroid tumour after this operation.

There is always a hæmorrhagic discharge from the uterus, commencing on the second or third day after this operation. This is also seen after the operation of double ovariotomy, and after the removal of the appendages for inflammatory disease. Until this discharge comes on, and sometimes it amounts to a flooding, there is usually some nervous disturbance. On this account it is well not to operate immediately after a menstrual period if the patient be very weak. The time to select is midway between the periods; the patient has then made up some blood, and the tumour has not commenced to swell.

On examination the ovaries can sometimes be felt through the abdominal wall, and when this can be done the incision will

be made near the umbilicus or near the pubes, as is most convenient. When they are not felt, the incision is to be made over the centre of the tumour long enough to admit two fingers. As soon as the broad ligament is reached, the fingers are passed behind it and as deeply in the pelvis as possible, and then in most cases the ovaries will be reached. The ovary is drawn up, the tumour being rotated if necessary, the broad ligament is transfixed as close to the tumour as possible and tied, and the ovary and tube are cut away as near the ligature as is safe. As soon as it is seen that there is not any bleeding the ends of the ligatures are cut short. When one has confidence in the method of tying, it is better not to leave a pair of forceps on the stump while the other ovary is being treated, as some tearing might result. The other ovary is ligatured and cut off in the same way and the wound is closed. When the ovaries are not at once come on, the fingers are to be passed over the top of the tumour and swept round the back of it towards the sides of the pelvis. In specially difficult cases the incision may have to be enlarged, to admit the whole hand, but with practice this is not often necessary. Some operators occasionally find it convenient to turn out the tumour, remove the ovaries, and then push back the growth into the abdomen or pelvis. This is not a practice to be recommended.

To elevate a small tumour it is necessary to get the hand well behind it, and if this can be done it will usually be possible to bring the ovaries within reach by a little manipulation.

A lady thirty-seven years of age was seen early in the summer of 1892 and gave the following history:—For years, the monthly losses had been increasing till the periods became so bad that she was hardly able to do anything. In the beginning of the year she was treated by electricity, evidently not after Dr. Apostoli's directions, as great pain was caused, and the abdomen was almost covered with numerous scars of burns caused by the passage of the electrical current. No benefit resulted. On examination a fibroid tumour of the uterus was found to

extend to within two inches of the umbilicus; the os admitted the tip of the finger, and a submucous part of the tumour could be felt attempting to become enucleated. The patient was advised to wait and see if the tumour would enucleate properly, as she did not wish to have more electricity, and absolutely declined to have the ovaries removed. To check the violent bleedings for a time the uterus was curetted. The lady came back in November 1892, she had lost much ground in the interval, she was thin, and the bleedings were worse than ever. The face was yellow, eyelids and lips colourless. The tumour was of the same size, the os was closed, and the sound showed that there had been no attempt at enucleation since the former visit. Removal of the ovaries was again advised and reluctantly consented to, as the lady did not wish to go home uncured, especially as her mother and brother were ill. The incision was made over the centre of the tumour long enough to admit two fingers, and the ovaries were reached and brought to the surface with difficulty. Towards the end of the second day the usual uterine discharge came on, it lasted five days and was not excessive.

Before the patient went home on the nineteenth day after the operation, the tumour had very sensibly diminished in size, but when last heard of the bleedings were still going on.

A patient thirty-three years of age had known of the presence of a tumour for five years. For the same length of time she had suffered from great losses of blood every month.

On examination the tumour was found to extend to midway between the pubes and umbilicus, rather more on the left than on the right side. The pelvis was packed with the mass, which extended on both sides to the pelvic wall and filled up the entire hollow of the sacrum. It was evident that the tumour itself could not be removed, so it was agreed to take away the ovaries if possible. The left one was to be felt high up on the side of the tumour. On the right side there was a tender spot, but no trace of ovary could be found.

The operation was performed in May 1886, the omentum was spread out over the tumour and adherent to it, and with some difficulty the left ovary was got hold of. The incision was enlarged and the ovary was brought well into view. It was fairly healthy, and the tube was dilated to the size of one's thumb. The broad ligament was transfixed as close to the uterus as possible, the ligatures were tied and the parts removed. The right ovary was deeply situated in the pelvis enclosed in the layers of the broad ligament. By drawing up the tumour and throwing light into the pelvis by means of the reflector, the exact position of the ovary was seen. Running over it and towards the bladder, which was drawn up and displaced to the right, the ureter was detected. Under the circumstances it was thought best to make no attempt at removal. The patient went home in three weeks, and the hæmorrhage was lessened for a time, but when she came back in November 1887, the bleedings were worse than before the operation, they lasted one week and recurred twice in the month. The tumour reached to the umbilicus. She was treated by electricity, applications of an average strength of 145 milliampères, for five minutes at each sitting, being given. On 11th June 1889 her doctor wrote as follows :—"She is looking a great deal better, and has lost the anæmic appearance which she had. She says that there has been no flooding for twelve months, she is quite regular in her periods, and the discharge is natural and painless; and this has been the case since four months after ceasing the treatment. The tumour is much the same as when I last examined her—a large globular mass, tender in parts on pressure, and as big as a five months' pregnant uterus. Mrs. M. has just been changing her residence, I found her working. She says she has no more difficulty than she had seven years ago, when her trouble first commenced, and can work all day without distress."

Hysterectomy.

The operation of hysterectomy for a fibroid tumour or myoma means the removal of part or the whole of the uterus along with the tumour. The removal of a pediculated fibroid tumour is an operation seldom required. In rare cases where the size of a pediculated growth is large enough to cause suffering, removal is necessary. In such a case the operation is one of extreme simplicity unless the tumour be closely and extensively adherent.

The incision is a long one, and after the tumour has been exposed it is drawn out of the abdomen after getting a firm hold of it with one or two corkscrews, or it is pressed out by the hand passed behind it. One or more large sponges are placed in the abdomen to prevent extrusion of the bowel while the pedicle is being treated and the stitches put in. If the pedicle be narrow enough to allow of its being transfixed and tied with safety, the tumour is then cut off, the pedicle dropped back, and except for the time taking in suturing the long wound the operation is performed in a few minutes. When the pedicle is thicker it may still be transfixed and tied with silk, if the neck be thoroughly crushed either in a clamp or in the grasp of a large pair of forceps. Should it not be possible to do this a temporary elastic ligature is put round the neck, but if this also cannot be done it is not of much importance, as there is usually little circulation in these tumours. The growth is cut off, leaving slightly curved anterior and posterior flaps, so as to make the stump concave. Any large vessels are tied. As a certain amount of pressure is required to stop all oozing it is not sufficient simply to bring together the edges of the flaps. Finest silk of undoubted purity is threaded on a curved needle, and brings together the deeper part of the stump, then the more superficial tissue is stitched in like manner until finally the peritoneal edges are brought into apposition.

Another plan is to pass stitches from one edge to the other through the whole thickness of the tissue, the silk never being exposed. The stump is then dropped back, or if a temporary ligature have been used, it must be removed and the stump watched for a little before it is allowed to pass out of sight.

The cautery is not a satisfactory method of dealing with these pedicles. Such operations are as simple as an uncomplicated ovariotomy, and the after treatment does not vary in any way.

Hysterectomy is often and, especially in the cases where operation is really necessary, a much more formidable operation. Adhesions when they occur are always specially firm and exceedingly vascular, and the hæmorrhage which results from their separation is sometimes exceedingly alarming. The reason of this is that the capsule is the vascular part of the tumour, and in it there may be sinuses of enormous size. The firmness of the adhesions is often so great that the tumour cannot be separated, and surrounding tissue may have to be removed along with the growth.

As an example the following may be extracted from Dr. Keith's book on *Hysterectomy*:—"The incision was upwards of twenty inches, and was as near the ensiform cartilage as was of any use. No line of demarcation could be made out between the peritoneum of the tumour and the wall; adhesion was everywhere most intimate. The tumour was cut into without any better result, and bleeding was free. The omentum also came in between the tumour and wall, adherent to both; and, as all the tissues were œdematous, this only increased the difficulty. The wall was rapidly cleared off the tumour by the free use of scissors. The transverse colon was firmly attached all along the upper margin; and, in separating this, it was deprived of its omentum and partly of its mesentery. Much force was necessary to tear out the tumour, on account of the firmness of the adhesions everywhere. These were temporarily secured by every available pair of locking forceps, forty-nine in number. About seventy

ligatures, partly of silk and partly of catgut, were left. The omentum was so lacerated that most of it was cut away. In some places the vascularity was great, especially where the bladder was separated downwards off the tumour. Finally, the stump was fixed in the lower angle of the wound along with both ovaries, and the incision was closed by thirty-five sutures. The peritoneum was so adherent to the tumour that it was almost all stripped off the wall, and in places the intestines were in contact with the muscles when the wound was closed. The operation lasted nearly two hours. The weight of the tumour was 35 lbs., and on examining it after its removal from the body it was impossible to separate the adherent peritoneum, even by careful dissection. Nearly the whole of the parietal peritoneum, and in places cellular tissue, remained on the tumour."

It is not, however, so much the difficulty due to the presence of adhesions that is to be feared, but the chief difficulty is owing to the way in which the broad ligaments are affected by the growth of the tumour.

Thirty years ago Dr. Keith was asked to see a woman forty-five years of age in Glasgow who had a very large tumour, which was supposed to be ovarian. He found it to be a fibroid tumour of the uterus which had opened up the folds of both broad ligaments, and had spread itself out so closely to the walls of the pelvis that he expressed the opinion that it could not be removed. Some time after he was asked to reconsider his opinion and to sanction an operation. The second examination simply confirmed the first, but he suggested that the surgeon in charge of the case should make an incision and satisfy himself. The tumour could not be removed even when a second attempt was made to do so *post mortem.*

A reference to the separation of the broad ligament by intra-ligamentous ovarian tumours will explain how this difficulty arises. The position of the uterus in relation to the broad ligaments also explains why this complication should be fre-

quently met with. The two broad ligaments may be considered as one ligament, in the centre of which is placed the uterus; the upper edge of this divided ligament reaches to the fundus of the uterus. At the spot where the round ligament comes off, the two folds of peritoneum may be said to be close together; as they pass down into the pelvis they become farther apart until they finally leave one another, the one passing backwards, the other forwards. The sides of the uterus are in direct contact with the cellular tissue between these folds of the ligament. It is therefore evident that any tumour of the uterus, unless it arise from the fundus or as a pediculated growth from the anterior or posterior surface, must, as it increases in size, open up one or both broad ligaments to some extent. The following case, operated on by Dr. Keith, is an example of what occurs when a tumour commences to grow low down on the side of the uterus. It will be noted that the relations of the tumour were exactly the same as those in the case of an ovarian tumour situated entirely outside the peritoneal cavity:—

"A married lady, aged thirty-two, having got a diversity of opinions in Glasgow as to the nature of an abdominal tumour which was first noticed after her marriage, went to London to consult the authorities there. All seem to have agreed that the tumour was ovarian. She might have an operation when she could not walk a mile, though at the time she could not walk a hundred yards without discomfort! She returned home much discouraged, for she felt that whatever the nature of the tumour might be, no one there seemed to care to have anything to do with her. She then drifted here (Edinburgh), as many a bad case has drifted before. She was fat, and seemed to be in fair health. Two years ago she had several severe inflammatory attacks with great pelvic pain, confining her to bed for weeks at a time. The abdomen was distended by a soft fluctuating tumour. Careful examination discovered the fundus of the uterus in the left loin above the crest of the ilium. The uterus

was tender, slightly movable, and of normal size. Internally, the finger entered a narrow tubular vagina, directed to the left and pushed forwards by the abdominal tumour which extended down close to the anus. The posterior wall of the vagina was very much stretched and felt very hard. The uterus could not be reached; indeed, the finger point must have been eight or ten inches from it. The local difficulties in the pelvis were evidently very great. At first, the impression was that the tumour must be one of those not uncommon ovarian cysts, where the right broad ligament was opened up and the uterus pushed to the opposite side; but here the fundus of the uterus was felt so distinctly, and was so very differently placed in every way from anything that I had ever seen, and so apparently separated from the cystic tumour, that I felt doubtful. I ventured, however, to say that, whatever it was, it was not an ovarian tumour. After a day or two I removed upwards of a hundred ounces of pure blood serum from the cyst. This did not nearly empty it, and the fluid came away, not in a full stream, but in a spasmodic sort of way, as I have seen it do in cases of uterine fibrous cysts, when these were punctured. The interior structure of the fibrous cysts quite explains the way in which the fluid behaves. But for the small and movable uterus, which, however, did not in the slightest degree change its position downwards, I would have said at once that the tumour was a uterine fibrous cyst. Now I hesitated between that and some undescribed form of retro-peritoneal tumour.

'In the meantime, as some relief had been obtained, delay was advised. In six weeks she was back again, having scarcely been out of her room. The swelling was larger than ever. The dulness now reached to near the ensiform cartilage, and the abdomen was generally fuller and broader-looking all over. Tension on the pelvis, on the vagina, and rectum was, if possible, greater than before. The uterus now touched the left false ribs. All along, menstruation was regular and normal.

"On 22nd October, a free incision was made from the um-

bilicus downwards. The cavity was opened at the umbilicus, as the position of the bladder was known to extend high up into the abdomen. On putting in the hand it was arrested by the bladder in front, and the same all round on both sides. The uterus was found in the left lumbar region touching the ribs ; the fundus, strangely free, was sticking out of the tumour like a potato. The tumour was punctured at the umbilicus ; about one hundred and fifty ounces of fluid were got away, but the sac would not empty. Its upper part was now seized and pulled forwards, and as it was dragged out the right healthy ovary and tube were seen to be stretched on it. The position of the ovary before the tapping must have been near the middle line, and about half way between the umbilicus and the ensiform cartilage. It was now seen that the whole of the tumour was under the peritoneum, and the floor of the pelvis was pushed up by the tumour almost to the sternum. The tapping puncture was enlarged, and the hand introduced into a fibrous cellular structure, with masses of fibroid here and there. The septa were broken up, and as much fluid pressed out as was possible. The thickness of the soft parts covering the cyst was remarkable. The edges of the cyst were then seized, and the long and tedious process of enucleation was begun. The solid portion extended to the very floor of the pelvis on both sides, and its connections everywhere were most close and firm, requiring all my strength to separate them. It was impossible after the first few inches of separation to bring any bleeding points into view. At last, after it had given way in several places, the whole tumour was turned out of the pelvis, and then its connection to the right side of the uterus came into view, all being separated but this. The point of departure of the cyst was immediately above the cervix on the right side and under the peritoneum of the broad ligament. There was no pedicle—only a broad thick connection. The cautery clamp was put on, but the structure being hard and dense, the crushing action of the blades made the tissues fissure at the point of junction, and it was removed. Any

bleeding points were tied with fine silk. There was now the huge gap left to be dealt with. Sponges were stuffed in, pressure was made, and the bleeding gradually diminished. The right ovary and tube, as well as a large part of the very voluminous capsule, were cut away. The edges were secured by numerous ligatures, and then fixed in the wound. Some iodoform was rubbed over the sac, a glass drainage tube put in, and the wound closed. The operation lasted one hour and twenty minutes. The patient made a good recovery."

A somewhat similar case was reported by Mr. Doran not long ago. When the tumour grows from the fundus and it is possible to remove it without opening the uterine cavity, the method of removal is exactly the same as that described when speaking of pediculated outgrowths.

If the tumour cannot be removed without opening the uterine cavity, one of two methods must be followed, the choice of which will depend on whether the stump has to be fixed outside or not. They are the extra-peritoneal, and the intra-peritoneal plans of treatment, and much controversy has arisen as to which plan is the better. The truth will be found to lie not in the one or the other, but will be determined by the circumstances of each case. Before describing these two methods, it will be well to show how the separation of the broad ligaments is to be effected. When the tumour is a large one, perhaps 20 lbs. or 30 lbs., and it has been determined after careful examination to remove the growth, there is not the slightest use in beginning with a short incision of four or five inches. Let the cut be long enough to get the tumour out whether it be ten or twenty inches, and if care be taken the peritoneum can often be opened with the first sweep of the knife. The incision should not reach too near to the pubes, and this is especially the case where the bladder is known to be raised into the abdomen. At the lower angle, the peritoneum must not be divided to the entire length of the skin incision. As soon as the wall is divided an attempt is made to push the

tumour out of the wound. This may be done, either by drawing the wall back over it or by passing the hand behind the growth and levering it out. Sometimes by rotating an irregular mass the extraction may be facilitated. When the tumour is small and of fairly firm consistence, a corkscrew with a wide spiral is to be inserted into the growth, and if it hold extraction is easily effected. In one case where there was great adhesion at the upper part, the uterus was temporarily clamped with forceps as the neck was thin, and the extraction was then effected from below. When the tumour has been got more or less out of the abdomen, several large sponges are put in to keep back the intestines, or a few stitches may be inserted to reduce the size of the wound and keep the bowel from getting in the way.

If the bladder be not adherent, the broad ligaments are separated in the following way: a large pair of catch forceps is fixed on to the upper part of the broad ligament close to the uterus, and a second pair alongside with just sufficient room to cut between. Strong well made forceps do not require that any tissue be left beyond their grasp. The part between is then divided with scissors. Two pairs are fixed in the same way lower down, the tissue is again divided, and this is repeated until the separation is complete. The other broad ligament is treated in the same way. When the separation of both is finished, the broad ligaments are transfixed and tied with silk, and when the separation has been extensive this will have to be done in detachments. The forceps are allowed to remain on the uterine end of the ligaments, and time need not be wasted by tying them, as is sometimes done. If the bladder have been raised up on the tumour, its separation is seldom difficult; the peritoneal covering of the tumour is cut through close above it, and it is separated downwards, bleeding vessels being caught up with forceps and tied. A neck or pedicle will now have been formed with the loss of almost no blood.

Another way of forming this neck is to make a circular

incision through the capsule or peritoneal covering of the tumour at its widest diameter, forceps are fixed on to every bleeding vessel, and the capsule is then separated downwards all round until a neck is reached. In cases where the broad ligaments reach high up on the tumour, they are usually partially separated in the way previously described, before the circular incision through the capsule is made. This separation of the capsule causes great loss of blood, and does not appear to have any special advantage over the other plan. It also involves a certain amount of danger, as the separation may be continued too low down, and in this way septic matter may be

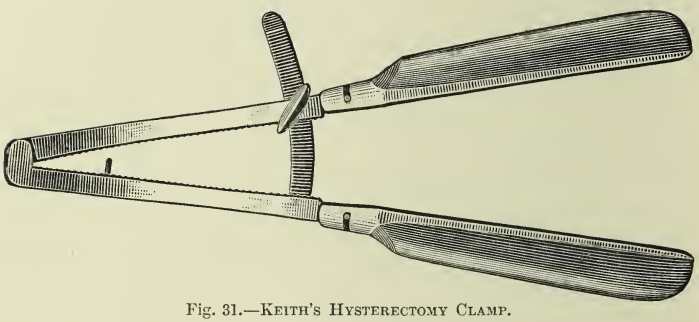

Fig. 31.—Keith's Hysterectomy Clamp.

shut up in the tissues below the clamp or wire. When the former method is used the clamp or wire fixed on to the neck is in contact partly with the peritoneum at the back and front of the uterus and partly with the raw surface at the sides; while in the latter method it is in contact with peritoneum all round.

The extra-peritoneal method consists in fixing the neck which has been formed into the lower angle of the wound, and before this can be done it must be constricted in one way or another. It is best done by the clamp of which a diagram is given. It is much the same shape as Wells' ovariotomy clamp, but is much longer, being nine inches in length including the handles, thinner, and fitted with movable handles so arranged that they cannot slip when the clamp is used. A single ligature is placed round the stump to prevent it spreading out too much;

the clamp is applied in the groove made by this ligature and the blades are fixed by the screw, after being pressed closely together. The tumour is then cut off, the return blood from the growth being prevented from entering the abdominal cavity by the assistant. The stump is trimmed, the opened uterine cavity is cut out, and the parts round it are washed with a strong antiseptic solution. The angles of the stump, where most of the vessels are usually situated, are ligatured beyond the clamp, and any large vessels in the capsule must also be tied. Sponging is completed, and special care must be given to the pouch which is formed in front of the pedicle. The stump

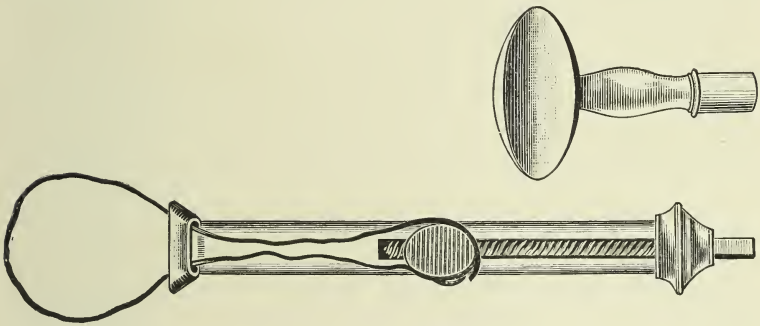

Fig. 32.—Koeberlee's Serre-Nœud.

must be fixed in the wound in such a way that the peritoneum is brought so closely round it that discharge cannot pass into the abdominal cavity, and it is to assist in doing this that the peritoneum at the lower part of the wound is not open to its full extent. This can be done in the following way: one stitch is passed through both sides of the abdominal wall immediately below the stump and so close to it that the peritoneum is brought firmly against it. The second stitch is put in above the stump and also close to it, so as to bring the peritoneum round the upper part and at the same time draw up the peritoneum of the sides of the wound. The peritoneal cavity is thus closed to any discharge which might gravitate from the cut surface of the stump. When all the stitches have been put

in and tied, the dressing is arranged round the stump and under the clamp. This in addition gives a certain amount of support, preventing the stump being drawn into the abdomen, and dispenses with the use of pins. It is neither wise nor advisable to cover over the stump by stitching the peritoneal edges together.

To the raw surface of the stump the saturated solution of the perchloride of iron is freely applied, iodoform is sprinkled over the dressing, and some absorbent wool is placed over all.

Instead of a clamp a wire serre-nœud is commonly employed. The wire is passed round the stump, fastened and screwed up, the tumour is then cut off as before described, pins are pushed through the stump immediately above the wire to give support and to prevent it being drawn into the abdomen.

Some illustrative cases may be given from Dr. Keith's book on Hysterectomy :—"Mary C., aged twenty-eight, was sent into the Royal Infirmary by Dr. Robertson of Ardrossan. She had sought relief in many quarters in vain. The tumour was very large, and was first noticed five or six years before. She was wasted about the chest and arms, like a case of old ovarian disease. The abdomen measured forty-nine inches at the umbilicus; the tumour was firm and solid throughout. The ensiform cartilage was turned upwards, and the growth extended under the sternum and ribs; close to the sternum there was a large projection the size of a child's head. No trace of the ovaries could be detected. The greater part of the pelvis was occupied by the tumour. There was no distinct cervix, only a small triangular projection drawn away to the left side, almost beyond reach of the finger. For several years no great inconvenience had resulted; menstruation was never in excess, and for the last fifteen months it had entirely ceased; since then, the increase in the size of the tumour had been rapid, and she could do little or nothing on account of its weight. She sat all day knitting; at twenty-eight her life prospects were anything but bright.

"For obvious reasons, this patient was not taken down to the large theatre, but was operated on in the ward, on 18th April 1881. Sulphuric ether was given and the operation was performed under carbolic acid spray. The sponges, thirty in number, had been lying for long in a 5 per cent. solution of carbolic acid, they were washed in hot water, and then put into a 2 per cent. solution, and wrung almost dry. These were used over and over again, and were not washed in any fresh solution during the operation. Dr. Wilson was present from Glasgow, and there were about twenty visitors and students. The first incision measured twelve inches; it terminated four inches above the pubes, so as to avoid the bladder, which was known to be elevated on the tumour. On the right side the broad ligament rose as high as the crest of the ilium. The left broad ligament was largely spread over the half of the tumour as high up as the ribs. The opening was then enlarged to twenty-two inches, and, by dint of hard pushing and patience, the huge mass was slowly moved forwards as far as its connection on the left side would permit. The right ovary was easily seen. On searching for the left, it was found to be transformed into a long, tense, umbilical-like cord, seven or eight inches in length. Here and there along this tense band were several small cysts. It was so embedded in the tumour that it could never have been removed. The right broad ligament was transfixed by soft iron wires, secured, and divided; all bleeding from the tumour side was prevented by a series of strong locking forceps. The fibroid was now more easily dealt with. It was drawn forwards, so as to put on the stretch its enormous connection on the left side. About a dozen powerful locking forceps, ten inches in length, were now applied to the broad ligament before and behind. The whole was then cut downwards, and the mass enucleated as low as possible. A strong soft iron ligature embraced the base, which was of great thickness. The tumour was then cut away, the stump showing a section of the cervix

in the centre. The forceps were removed one by one, and all bleeding vessels separately tied. Some of these were large, and one threw blood over the assistant's head. There was much trouble in finding some bleeding points amongst the loose cellular tissue of the huge gap now left. The hæmorrhage was mostly venous. All present could see that this condition was full of danger, and that secondary hæmorrhage into this loose tissue was not one of the smallest risks of this operation. When all oozing seemed to have ceased, the stump (the thickness of the leg) and the end of the right broad ligament were secured, with much tension, outside; a glass drainage tube was fixed in above the stump, and the wound closed by forty silk sutures. The operation lasted one hour and three quarters. After much blood and serum had escaped from the tumour, its weight was 42 lbs. The patient recovered."

"Mrs. B., aged thirty-nine, was transferred from Professor Fraser's wards in the medical house. Since the birth of her last child three years before, the tumour had rapidly increased. It now reached the ensiform cartilage, completely filling the abdomen. Menstruation was frequent and profuse. Projecting from the vagina were four distinct swellings; prolapsus of the vaginal wall and bladder; prolapsus of the rectum and posterior vaginal wall. Between these were two large ulcerated swellings, like two fists, exuding a fœtid discharge. These were found to be the lips of the cervix enormously enlarged; behind and pushing outwards, was the tumour completely filling the pelvis. These local wrongs had thoroughly broken down her health. Her life was utterly useless, and her condition in every way was most miserable. She was a nervous, excitable person, bedridden, feeble, and emaciated. She was willing to run any risk to obtain relief. The case was far from a promising one, and, at first, the condition of the kidneys seemed to forbid any interference. The urine was of low specific gravity, 1012. The daily quantity passed during the week before operation

varied from eighty to one hundred ounces. There was a little albumen, but nothing else.

"The operation was performed on 13th November, and lasted one hour and twenty minutes. The incision was eighteen inches long. This opening was scarcely large enough, and much force was needed to push the tumour forwards, and especially to dislodge and bring up the pelvic portion, which was tied down by bands of adhesion everywhere in the pelvis. The steps of the operation were the same as in the previous case. The broad ligaments were stripped off and secured separately, and everything fixed in the lower angle of the wound. On proceeding now to remove the clots from the abdomen, a cystic tumour of the right kidney, as big as a child's head, was brought into view. It was pushed under the ribs by the tumour, and as the operation went on it came lower and lower into the abdomen. It was covered by adherent mesentery, and was of a very dark colour. It was not examined too curiously. The weight of the tumour removed was 21 lbs. The patient looked very ill on being placed in bed. Indeed, at this stage she presented a very hopeless appearance. The interest of the case now centred in the state of the kidneys, and in what would be the probable effect of the carbolic acid spray on such a damaged organ. Soon after the operation she was seized with severe pain, which was relieved by drawing off a pint and a half of limpid urine, slightly albuminous; in eight hours fifty-three ounces were passed. The first night was fairly good, with an opiate. In the morning the pulse was 104, and the temperature 101·8. Fifty-seven ounces of urine were passed during the day, making one hundred and ten ounces in twenty-four hours. It was clear with more albumen. The second night was bad. In the morning she was flushed and intensely cyanotic; the pulse was 134, and the temperature 101·2°. The urine was smoky, and towards evening it became bloody, and was loaded with albumen. The quantity was fifty-seven ounces during the day. She complained of intense headache, and was flushed and restless all day; the

pulse was 130, and the temperature 101°. The third night was also bad; in the morning the pulse was 128, and the temperature 101·4°, the urine was very bloody. The fourth and fifth nights were also restless. The urine still contained much blood, and some clots caused much distress in passing from the urethra. On the sixth day the urine was free of blood but loaded with albumen. On the next day there was a return of the hæmorrhage, with much pain. On the tenth day blood was observed for the last time; then came a week of great exhaustion from diarrhœa; on the twenty-third day all trace of albumen had disappeared. There was free suppuration round the stump, though the wound healed well. She went home seven weeks after the operation, looking clear and healthy. She was freed from all her troubles. The vaginal and rectal prolapsus had disappeared. The cervix was tucked up under the pubes. Strange to say, the kidney tumour has as yet—now nearly four years after the operation—caused no inconvenience, though it has slightly increased in size."

"A widow, thirty-eight years of age, from Scarborough, was admitted into the Infirmary on 19th June 1883. She had a very large uterine fibroid. There was œdema of the limbs and of the abdominal wall, which was hard and horny, and ulcerated in several places. The œdematous portion of the wall below the umbilicus formed of itself a tumour as large as the adult head—it reached to the knees. The tumour hung over the pubes, filled the abdomen up to the sternum, and, after some days, when the surface swelling had subsided, was seen to move freely with respiration. The cervix was high up and of moderate size.

"The tumour had been noticed at least ten years ago. Its growth of late had been rapid. She was obliged to work hard, and she had worked on till she could now work no longer. She was a thin, not unhealthy-looking woman, but the pulse was extremely feeble. All these years menstruation had been abundant, though never amounting to severe hæmorrhage.

"After ten days' rest, the swelling of the limbs and abdominal wall having subsided, and the ulcerated patches having healed, an operation was performed on the 30th of June. From the free mobility of the tumour, a difficult operation was not anticipated. An incision of about fourteen inches was made, and an attempt made to push the tumour through it. It was necessary to enlarge the opening. After a good deal of pushing the tumour only moved partly into the opening: perhaps one-third of it projected. More force being applied, a red fringe of adhesion began to appear all round the sides, the tumour then slowly came out, but its posterior surface was simply covered with adherent omentum, intestine, and mesentery, and the connection was of such firmness that all adhesion had to be cut. It was afterwards found that the raw surface on the tumour measured 30 × 31 inches. It was possible to put a clamp round the base, and the tumour was then cut away; then, bit by bit, this large adherent surface was tied by catgut ligatures. An immense number of these were used, and some of the vessels in the mesentery were very large. There was a curious cystic condition of the mesentery, such as I have not seen before. There were hundreds of small serous cysts, and as many of these adhered to the tumour, it was no easy matter to get all the bleeding points stopped amongst them. After an hour and a half, the wound was closed by thirty-five stitches. The weight of the tumour was 30 lbs. I regretted afterwards very much that I did not drain. She was feeble from the beginning: four hours after operation the pulse was 140, and it was only then that I became aware how exceedingly thin she was. She had a fair night, but was more feeble next day, the pulse continuing rapid. The skin was moist, and the kidneys acted well. Flatus passed early and easily. She took food and stimulants well. There never was any pain or sickness, and on the fourth day we were all hopeful. On the fifth day there was a sudden rise of temperature to 103°. A fine glass tube was pushed into the pelvis above the stump of the pedicle, and six ounces of thick, black

syrupy blood were removed. The fluid was quite sweet, and contained no organisms. Nearly other four ounces were got away in the evening. She gradually became weaker, and died on the seventh day. Though almost hopeless about her when put to bed after the operation, her chances would have been better had drainage been carried out from the first."

The following case is a good example of the difficulties and complications which may be met with. For six or seven years, a patient forty-three years of age had suffered from menorrhagia, and about two years afterwards an abdominal swelling was discovered. For about three months before she was seen in November 1892, the general health and strength had rapidly failed, the patient having lost 14 lbs. in weight in one month. A thoroughly competent gynæcologist was consulted, and after several examinations a diagnosis was written of a fibroid tumour in the abdomen, and a second tumour in the pelvis, probably of a malignant character and surrounding the bowels.

On examination an irregular uterine fibroid was felt extending to within two inches of the ribs. In the pelvis, the vaginal walls were found to be very œdematous, and through them a hard but not absolutely solid tumour could be felt. The cervix was drawn completely out of reach, and movement of the abdominal mass did not appear to affect the pelvic growth. The patient looked ill and the pulse was 96. A definite diagnosis was not made, and the patient was asked to come back after the period was over. At the second examination the pelvic portion was felt to have some slight lateral movement on manipulating the abdominal tumour. The patient's mother had had a baby at the age of fifty-one. Removal of the tumour was advised on account of the rapid decrease in strength. There had been no feeling of chill or other symptom suggesting suppuration.

The incision extended from three inches above the umbilicus to a similar distance above the pubes, and the tumour was partly drawn forwards by the help of a couple of corkscrews. On

passing in the hand to discover why the growth would not come out entirely, two great soft tubes the size of the wrist were found to be connected to the tumour, and were also adherent to the walls and bottom of the pelvis. Owing to their position behind the tumour, the contents could not be emptied with the aspirator ; and during the separation of the tubes both ruptured, the contents being grumous pus without odour. The broad ligaments were separated off the sides of the tumour, and still a neck was not made. The capsule above the bladder was divided transversely, and was enucleated downwards with difficulty, as there had been old inflammatory matting together of the tissues. Finally the clamp was got round the stump of the uterus, including the left ovary, and the connections of the right ovary and distended Fallopian tube were ligatured separately. The pelvis was thoroughly washed out with warm water and a drainage tube, seven and a half inches in length, was placed in the abdomen. The operation lasted one hour and forty minutes, and the pulse was 116 when the patient was put back to bed. At the end of thirty hours it had risen to 134. It commenced to fall after the bowels were moved with the white mixture, and by the fifth day the condition of the patient was perfectly satisfactory : pulse 80 and temperature normal. She was seen on the ninth day at ten P.M. and was then found to be very well. About an hour afterwards she partially woke up out of her sleep, sat up in bed, threw her arms out once or twice, gasped, and expired, evidently from a heart-clot.

"M. D., aged 37, had been under observation for four or five years, with a large bleeding fibroid. The cavity was nine inches in length, and everything in the way of remedies had been tried in vain. The condition in the pelvis was so unfavourable that no interference was recommended. She got gradually more and more anæmic and feeble, until she could no longer find employment as a cook. She was friendless and her means were exhausted. She was admitted into the hospital in August—more to give her rest and good food than with the view of trying

anything to effect a radical cure. She got worse instead of better, and was even more blanched than before. The effect of the good living seemed only to cause more blood to flow from the uterus. There was a constant drip going on, varied every now and then by a real hæmorrhage. As she had still ten years or more of invalidism to look forward to at the best, her position was explained to her, and she agreed to anything being done that might be deemed feasible. The tumour reached two inches above the umbilicus. It was softer than any of the other cases, and more so now than at any previous time, for it was well drained by long-continued bleeding. There was no cervix, and the mass filled up Douglas's space nearly to the anus. The operation was done on the 26th October, after a residence of nearly three months in the hospital. She had long suffered from a chronic laryngitis, and the ether inhalation was difficult. It was agreed to remove the ovaries should they be removable, for great doubts were entertained as to the possibility of removing the pelvic portion of the tumour. A free incision was made, the ovaries could not be got at, and the tumour was turned out. The ovaries were found high up and behind. They were much enlarged, adherent, and embedded in the midst of enormous varicose veins. They might have been ligatured close to the tumour; but then the pelvic part of the tumour, which had been got up by much pulling, could never have been replaced again. The case looked pretty hopeless at this stage, and it was evident that great enucleation would be necessary before the wires could be placed under the pelvic portion of the tumour. The bladder came half way up upon it, and the base was as thick as the thigh, more than filling the opening of the pelvis all round. The bladder was first detached; the peritoneal covering of the tumour was divided by scissors right across, a little below a point corresponding to the situation of the umbilicus before the tumour had been disturbed. Then each broad ligament was ligatured by soft iron wires, and detached from the tumour, strong locking forceps controlling all the bleeding. The

separation was continued by the scissors all round until the top of the vagina was reached, when a serre-nœud was applied as low as possible. The tumour was then cut away, all bleeding in the pelvis stopped, and the stump secured in the wound. The tension was not greater than in the previous cases, while the tissue embraced was smaller. There seemed to be nothing held by the wires but the top of the vagina. The operation lasted one hour and thirty-five minutes. The weight of the tumour was 12 lbs. No spray was used during this operation, and the sponges were simply wrung out of hot water.

"For the first week there was laryngeal irritation, followed by slight bronchitis. Still, considering her feeble condition, convalescence was unusually rapid. The opening left after the wires dropped off was not larger than in an ordinary clamp ovarian operation; not a trace of cervix could be felt by the finger. The vagina ended in a simple *cul-de-sac* close to the cicatrix in the abdominal wall. The whole organ had been removed."

The following case is an example of hysterectomy performed after the menopause. The patient, an unmarried lady of forty-two years of age, was first seen towards the end of 1891 suffering from fever, from pain and tenderness in the lower part of the abdomen, and from great irritability of the bladder. Menstruation which had always been scanty and irregular had ceased for about a year. The general health had never been good.

The fever, due evidently to an attack of pelvic peritonitis, had lasted for six weeks and had been set up by a fall. On examination the patient was found to be thin, the pulse was soft and quick, and the temperature was 102°. The lower part of the abdomen was exquisitely tender, and a tumour could be seen bulging immediately above the pubes and extending upwards for five inches. The cervix was very large, and the pelvic contents were absolutely fixed. The diagnosis arrived at was that there was a uterine fibroid with surrounding cellular inflammation.

After a few days' rest, treatment by electricity was com-

menced, eighteen applications varying in strength from 60 to 90 milliampères being made between the beginning of November and the middle of December. The size of the abdominal swelling was not greatly reduced though the cervix became much smaller. The symptoms were, however, entirely relieved, and the patient went home.

In the following July she returned to town. She was better generally, but an attack of pelvic peritonitis had greatly discouraged her, and she found that she had to pass most of her time on the sofa. She was very anxious to have the tumour removed, more especially as she had the fear of future attacks of fever constantly before her. The local state had changed somewhat, the tumour itself was not tender to the touch, but there was a sausage-shaped and very tender swelling projecting from its left side. Hysterectomy was strongly recommended, as the tumour had shown no signs of quieting down during nearly two years after the cessation of menstruation. A consultation was held at the desire of the friends, and an equally strong opinion was given that the patient should be content to wait, and hope for recovery without treatment. This she declined to do, and the operation was performed in July 1892. The tumour was universally adherent, the broad ligaments were opened up to their full extent, and the sausage-shaped swelling was found to be the broad ligament enormously distended by inflammatory deposit. Shortly after the operation was begun the anæsthetist said that the patient was becoming very much collapsed. The stump was fixed outside in a clamp. The after progress was slow on account of extreme feebleness, so great that even a month after the operation the patient often felt as if she was sinking through the bed.

At the end of six months there began to be some slight return in strength, but it was fully another year before she could say that she was really quite well.

The intra-peritoneal method may be carried out in three different ways.

The stump may be treated as already described by bringing the two flaps together. The cervix may be brought into the vagina by an incision through either the anterior or posterior fornix. The whole of the uterus may be removed.

A number of slight modifications have been advocated by various operators in the way in which the first of these methods is to be carried out. It is impossible to describe every little detail, nor is it necessary, because, when the main features are understood, the exact way in which they are carried out must be determined by the conditions found at the time of operation. The two main objects to be borne clearly in mind are, that bleeding must be arrested, and that some means must be found to prevent the stump from becoming septic. One direction which is usually given is to commence by securing the ovarian artery, but how this is to be managed when both broad ligaments are raised as high as the ribs, it is difficult to imagine. When the ovarian artery can be ligatured it is very evident that the case is one of the simplest nature, and that the broad ligaments have not been opened up to any extent.

The broad ligaments must first be divided between forceps in the way already described until an elastic ligature can be put round the neck. The tumour is then cut away. The cavity of the uterus is carefully cut out, and the stump is so trimmed that the anterior and posterior edges can be brought together. All vessels which are visible in the capsule are carefully tied, and the deeper parts of the stump are brought together by a continuous silk suture. Additional layers of continuous sutures are put in until the whole of the stump is doubled together, and finally the peritoneal edges are brought into accurate apposition. The elastic ligature is loosened, and if the vessels have been properly tied no blood will escape. The elastic ligature can be left in, if it can be covered by peritoneum, and when this is done, fewer stitches are required. Buried sutures may be passed deeply through both flaps instead of making several

layers. The objection to this method lies in the possibility of the stump becoming infected through the cervical canal. Should this occur the cervix will require to be dilated from the vagina, to allow of free drainage. With the possibility of this in view, it is well to notice at the time of operation how much of the uterus has been removed. In any case some iodoform gauze should be placed in the vagina to prevent any discharge from the cervix becoming putrid. In other respects, the remainder of the operation and the after treatment do not vary from that of an ordinary ovariotomy, but it is well to leave a drainage tube in the peritoneal cavity for twenty-four hours in case of hæmorrhage.

The object of drawing the cervix into the vagina is to prevent risk of septic poisoning. After the vessels have been tied, the stump is transfixed, and ligatured in several places. A long pair of forceps is then passed into the vagina which has been thoroughly disinfected, and is pressed against the anterior or posterior fornix, whichever happens to be the more convenient. An opening is then made from the abdominal cavity upon the pair of forceps in the vagina, and, passing the forceps through the opening, the stump is caught and drawn into the vagina. This manipulation is by no means easy, it takes time, and it cannot be made use of when the stump is very thick. On the whole it is not to be recommended.

The third way of treating the stump in the intra-peritoneal operation, is to go on with the enucleation until the whole of the uterus has been removed, or more usually, by temporarily clamping the neck, removing the tumour, and then going on with the enucleation. The precautions are, to have the vagina thoroughly clean, and to keep a careful look-out for the ureters. The opening in the roof of the vagina is closed with catgut stitches, and a plug of iodoform gauze is left in the vagina for forty-eight hours.

The following is an example of a case treated intra-peritoneally by Dr. Keith twelve years ago :—

"Mrs. D., aged forty-six, a Frenchwoman, sent by Dr. Thomson of St. Helier, was admitted into hospital, in August 1882, with a very large soft fibrous tumour. Dr. Thomson had aspirated in various places without getting more than two or three drachms of fluid at any point. The serum always coagulated in the syringe. Since menstruation passed away, the growth of the tumour had been rapid, her size having doubled within the last twelve months. She had applied for relief at various London hospitals.

"She was a little woman, thin and worn. The tumour uniformly distended the abdomen, elevating the ribs; no movement could anywhere be detected. The cervix uteri was very hard; it lay low in the pelvis to the right side, and was quite fixed. The upper pelvis was occupied by the tumour, and it felt very hard on pressing upwards; no movement of the abdominal portion in any way affected the part felt in the pelvis. Posteriorly, and better felt by the rectum, was a hard cystic body, the size of a small orange. This was supposed to be one of the ovaries. In prospect of an operation, the state of the parts in the pelvis was far from satisfactory, and repeated examinations threw no light on the local conditions.

"Operation on 28th August.—The incision was gradually extended to twenty inches, and the tumour was slowly pushed towards the opening. By taking time it moulded considerably, but could not be brought out on account of its extensive connections. It had grown from the left side of the uterus, had pushed aside the layers of the broad ligament, and forced everything before it as it grew, so that the descending colon was found on its right side; only about two-thirds of the tumour had a peritoneal covering; the rest required to be separated from its cellular attachments. The separation was begun by dividing with the scissors the serous covering at the edge of the colon, which was pushed over to the right side of the abdomen. Large vessels were secured by locking forceps. When the tumour was turned out, the iliac vessels, the psoas

muscles, and the loose cellular tissue nearly as high as the diaphragm, were lying quite bare; there was nothing like a neck or pedicle. A temporary ligature was screwed tight, as low down as possible, and the mass cut away. Nearly an hour was taken in stopping bleeding, and in hunting out vessels amongst the numerous thrombi that had formed everywhere in the cellular tissue. The base of the tumour could in no way be secured externally, and it was only by the use of special compressing clamps, which were expressly made for this case, and by which the elasticity of the thick uterine tissue was destroyed, that ligatures could be used with any hope of keeping a hold. The uterus was divided obliquely. Some vessels were secured singly, but the mass of the stump was tied in seven or eight portions with strong silk. The difficulty at this stage was to avoid injuring the bladder, which was very large, and drawn upwards to the left on the abdominal wall. It was only by keeping in a catheter and moving it about that the bladder escaped injury. It had already been separated from the tumour, and had got very rough handling. The gap left in the peritoneum was very large; the descending colon and sigmoid flexure were lying quite loose. A drainage tube was left in, and the wound closed. The patient, when put in bed, was cold and collapsed, the operation having lasted one hour and three quarters. Clover's small inhaler was employed; one ounce and three quarters of ether only were used. After drainage, the weight of the tumour was 34 lbs.

"Recovery was for long doubtful. The after progress contrasted greatly with that of those cases in which the extra-peritoneal method was carried out. The outmost vigilance was taken to prevent the stagnation of the fluids in the pelvis; this was the more necessary, as the cavity of the uterus was opened, and the quantity of strangulated tissue was great. No very unfavourable symptoms appeared till the end of the first week. Fortunately, at that time, a collection of putrid blood-clot was detected and opened by using the drainage tube as a probe and

pushing it about in the proper direction. In the second and third week the pulse and temperature were sometimes high. Little could be taken except stimulants; for a long time nourishment was given by the rectum, and the feebleness was great. Many silk ligatures were washed away; the discharge, though never great in amount, continued for three months. Long before this she was up and going about. After a residence of nearly four months in the hospital, she left for Jersey, the picture of health and contentment."

Drainage of the abdominal cavity is used in the same way as after ovariotomy. When the extra-peritoneal method is employed, the end of the tube comes out between two stitches a little way above the stump.

It is always better to remove the ovaries along with the tumour.

The advantages of the intra-peritoneal method are, the convalescence is shortened, the patient is able to be out of bed as soon as after an ordinary ovariotomy; there is less risk of septicæmia when the whole uterus is removed, though this risk from the stump can be reduced to a minimum by the proper drying of the cut surface with perchloride of iron, and by using an antiseptic dressing; the dragging pain in the back is avoided; there is no pouch in front in which fluid can collect; the risk of mechanical obstruction is avoided; and when the entire uterus is removed, there can be no growth from the stump, as has been known to occur in at least one instance.

The advantages of the extra-peritoneal method are, that the neck can be fixed in a clamp more quickly, and should bleeding occur from the stump it will be external.

The operation should always be begun with the intention of performing the intra-peritoneal method and removing the whole organ if possible, but the operator must be prepared to adopt any method, should it seem best to do so when the exact conditions are found out during the progress of the operation.

The after treatment, when the whole organ has been removed by the intra-peritoneal method, does not differ from that pursued after an ovariotomy. With the extra-peritoneal method, and especially when there is much tension on the stump, there may be difficulty in getting the flatus to pass downwards. Should there be much distension, the dressing round the clamp may be removed to allow the pedicle to sink in a little, or it may even be necessary to remove the clamp, and support the stump either with pins or with catch forceps.

"A lodging-house keeper, forty years of age, was sent to me by Dr. Joseph Bell. She had suffered for a very long time from pelvic troubles caused by a solid tumour filling the pelvis. The cervix uteri, enlarged and ulcerated, generally projected externally. There was also cystocele and rectocele. Her sufferings had lately been very much aggravated by the wearing of a large guttapercha pessary, like a three-legged stool, which a homœopathic practitioner had introduced to support the uterus. Relief was obtained by the removal of this apparatus, and with the help of hot water injections she was able to work on in comparative comfort. The tumour could not be pushed out of the pelvis, though it did not appear to be fixed. It reached half way to the umbilicus.

"About eighteen months after this, it was necessary that something should be done. The tumour had increased; the pressure in the pelvis was greater and now the large cervix was always outside, the tumour pressing downwards like a child's head on the stretched perinæum. The distress from prolapsus of rectum and bladder was incessant. The tumour reached to above the umbilicus.

"Operation was performed on 18th August 1883, and lasted upwards of an hour. The bladder was drawn up in front and to the left of the tumour. The tumour came easily out of the pelvis; the broad ligaments were, however, short and tight, enveloping nearly the whole of the tumour. They were separated, secured by silk ligatures, and fixed outside as they were very

voluminous, along with the stump. The tumour weighed 6 lbs., and the cavity extended nearly the whole length of it.

"Second day after operation.—The night was passed fairly till five A.M., when she was seized with severe abdominal pain. This continued, in spite of an opiate given by the nurse, till I saw her at nine A.M. She was then restless from pain and was flushed. Pulse 114, temperature 102°. Several hypodermic injections were needed through the day, and by evening she was easier. Her breathing, however, was rapid. The pulse had risen to 124, temperature 104°.

"Third day.—Some disturbed sleep with an opiate. She is very flushed. Temperature 103°, pulse 120. Some fulness at the epigastrium. Much flatus coming up, with pain. In the afternoon temperature rose to 105°; the feet and legs had got cold, and towards evening there was severe bilious vomiting. By midnight she seemed better. Temperature 103·5°, pulse 122; skin hot, flushed; much flatus coming up, none down.

"Fourth day.—Not looking so well. Abdomen is fuller and harder, but no pain; no flatus has passed down. Temperature 102·5°, pulse 128. Severe vomiting all afternoon of dark brown fluid, which comes up with much straining. At ten P.M. the abdomen was a little softer. Face flushed; much thirst; mouth and tongue very dry. She was distressed and restless. No flatus had yet passed down; much comes up. She takes whisky and water freely.

"Fifth day.—Very restless night. Temperature 102·1°, pulse 118. Skin very dry and yellow. Expression not good; restlessness, in spite of opiates, is constant. Vomiting of yellow bile in large quantity continued all day from time to time, with much straining. Urine copious. Wound quite dry. Removed dressing round clamp; everything quite dry. There is great depression of the clamp; as the ligature round left broad ligament, which is secured to the screw of the clamp, seemed to be very tense, it was divided; it slowly receded into the abdomen. Temperature 103°, pulse 118.

"Sixth day.—Much better night. Flatus has passed downwards freely since two A.M. Temperature 102·1°, pulse 110. By evening temperature had risen to 103°, and flatus had ceased to pass down; much coming up.

"Seventh day.—Fair night. Abdomen much distended; no flatus has now passed for thirty hours. Enemata given and returned without relief. All ordinary means had failed, and everything was vomited. By evening temperature was 105°, and pulse 140. Wound perfectly dry and healed, but much on the stretch.

"Eighth day.—Bad night; hot and flushed. Pulse 136, temperature 102·5°. Much more feeble. Under cover of a hypodermic injection of morphia, a large dose of castor-oil was given and retained. Bowels were freely moved in afternoon. Abdomen less full, though not much.

"Ninth day.—Night good with opiate. Free discharges from the bowels. Temperature 102·6°, pulse 118.

"Eleventh day.—Abdomen flat. Removed stitches. Wound quite dry and healed; dressing round clamp still quite dry. Temperature 102°, pulse 104.

"Sixteenth day.—Clamp came off; opening left very small. Temperature is still 102°, though there seems to be no cause for it.

"After this there was a rapid convalescence. Much mucus came away from the rectum, but no pus was ever visible, and there never were any indications of its presence in the pelvis. She now enjoys perfect health, and is entirely free from all her former troubles."

For some days there is usually considerable pain of a dragging character from the back. The dressing of the stump need not be looked at for at least a week, unless there appear to be any special reason for doing so. There is always some, but not much, suppuration round the clamp. The tissues do not separate for about three weeks; should this process be very slow, the clamp may be removed, and as much of the hard dried-up

tissue cut away as possible. With the clamp there is much less sloughing than when the serre-nœud is used, as the tissues are spread out and not so much constricted. Sloughs are removed without cutting if possible, and the wound is healed in from five to seven or eight weeks. Sometimes one side of the pedicle below the clamp may protrude, making a sort of hernia. This is not of any special importance, and does not require treatment, for it gradually sinks down after the clamp is removed.

Removal of fibroid tumours not extending above the umbilicus by *morcellement* is recommended by Pean. The tumour and uterus are removed in pieces through the vagina, as in the removal of large submucous tumours. This plan does not appear to us advisable.

The chief advantage in Apostoli's treatment is its freedom from risk and avoidance of mutilation; of removal of the ovaries, almost entire freedom from risk, but accompanied by mutilation; and the operation of hysterectomy means absolute removal of the uterus.

There are thus four ways of treating fibroid tumours of the uterus, giving rise to troublesome symptoms. Rest, diet, care of the general health, and perhaps curetting, will be the treatment when the patient is at or about fifty years of age, when the symptoms are not very severe, and when the circumstances are such that she can afford to take care of herself. Many such cases at about this age do not require even this amount of treatment; the general health of the patient is often so good that even although the tumour be large, it is not necessary to do anything. The practice of removing such tumours is bad; no woman ought to be allowed to run the risk at this age unless under very exceptional circumstances.

Every tumour not large enough to cause disfigurement and not giving rise to symptoms must be left alone. It must be carefully watched, be seen three or four times a year, and its relations to menstruation must be well kept in view. As long

as it does not grow or increases very slowly it may be safely left alone.

Electricity as applied by Dr. Apostoli is to be used in every case of tumour extending not more than two inches into the abdomen when the patient is not over forty years of age. The only exceptions are, when there is ascitic fluid or a profuse watery discharge not due simply to anæmia, or when the growth is a fibro-cyst.

In such small tumours when the patient is over forty but declines to have any operation.

In most cases where the tumour is larger and does not extend above the umbilicus and the patient is under forty years of age, the exception being when she cannot afford the time necessary for treatment, when the tumour is cystic, when there is ascites or profuse leucorrhœa, and in some of the very soft œdematous tumours.

When the patient with one of these larger tumours is over forty and declines operation.

In large tumours, say of 15 or 20 lbs., when the patient is well up in years, for the purpose of tiding her over the menopause; or when operation is absolutely declined, or when the operation would be one of special difficulty or danger, due either to the amount of adhesions or of enucleation required, or to the constitution of the patient, or to some intercurrent disease.

It may be used even as a preliminary treatment to hysterectomy, when the health of the patient is much broken down.

Removal of the ovaries is to be advised in all cases where the tumour does not rise much above the umbilicus, when the patient is over forty years of age.

When one is not certain that the ovaries are closely adherent to the tumour.

When a patient cannot afford the necessary time for Apostoli's treatment.

When Apostoli's treatment has failed to cure a small tumour.

Hysterectomy is to be advised in large tumours in young women.

In fibro-cystic tumours.

In soft œdematous tumours.

When there is ascitic fluid surrounding the tumour, or where there is a profuse watery discharge not due to anæmia.

When both Apostoli's treatment and removal of the ovaries have failed.

It must always be borne in mind that every case of fibroid tumour must be treated not solely as a lump to be got rid of, as is the case with a tumour of the ovary, but after all the circumstances of the growth itself, of the patient, and of her surroundings have been taken into consideration. We have to advise what is best under the circumstances.

For a woman over forty years of age, the mutilation involved by the removal of the ovaries is a matter of very little moment, and the risk to life is so slight, that the advantages of operation seem to overbalance the disadvantages. For example, we have within one week advised no treatment, electricity, removal of the ovaries, and hysterectomy, to different patients.

In 1885 Dr. Keith wrote of hysterectomy as follows:—"For myself I was slow to begin this operation. Many uterine tumours of all kinds have passed through my hands. The greater number of these gave little or no trouble at any time. In some there were times of pain, and attacks of hæmorrhage, and then long intervals of repose; a few even entirely disappeared of themselves, and many, I may say hundreds, got over the menopause with little disturbance, though, as a rule, menstruation was prolonged. But there were some who suffered almost without ceasing year after year, and at the time death would often have been welcome. Now, I sometimes see some of those old bad cases of whom I was wearied,—and who, I am sure, were equally tired of me, enjoying a fair amount of health, and able to live like other people. Wishing to have their view of the situation, I tell them that nowadays their tumour would

be removed, and that, had they lived a little later, much of their former sufferings would have been spared them. The reply has invariably been, 'I am now so thankful that I had no operation.' I meet the old fibroids in patients of all ages. I saw one the other day in a healthy old lady of eighty-four. I see almost daily in the street one whom I tended for years. She led a dreadful life with her tumour for upwards of twenty years, till it had reached an enormous size. Now it gives no trouble. She is nearly seventy years of age, and year by year her size is becoming less and less perceptible: that some have dropped by the way, unheard of, is likely enough."

CHAPTER V.

MALIGNANT DISEASE OF THE UTERUS, ETC.

For practical purposes malignant disease of the uterus can usually be divided into two classes, the first and most common, cancer of the cervix, and the second, cancer or sarcoma of the body.

Causes of Cancer.

The causes are not well known, heredity plays an important part, and the irritation of a lacerated cervix seems often to be the starting point of the disease. Dr. Emmet says that he has never seen cancer of the cervix except in women who have had either a child or an abortion, and this has been also our experience. The connection between these conditions is so close, that it is advisable to close a small cervical tear in a woman with a family history of cancer, even when the symptoms due to the laceration are not otherwise severe enough to justify the operation.

Diagnosis.—The diagnosis of cancer of the cervix is not always easy in the very early stages, more especially as one has seldom the opportunity of gaining experience by examining these cases until the disease is well advanced. It occurs most frequently at about the time of the menopause, and this is one and probably the chief reason why patients so often do not apply for relief until it is too late. At first the only symptom is often some irregularity in menstruation, the flow becomes increased

and may last longer than usual, or it reappears if the patient have passed the menopause. There may be some bloody discharge on exertion, after straining at stool, or after a drive over a rough road. When this is not accompanied by pain, the patient pays little attention to it, as the common belief is, that cancer is always accompanied by pain of a darting or shooting character. This symptom, though common, may be entirely absent for a long time, and it is even said to be sometimes wanting during the whole course of the disease. After a time there is discharge due to ulceration and breaking down of the tissues; it is thin, not purulent, looks like dirty water, has a most offensive odour, and is only to be confounded with the discharge from a sloughing fibroid tumour or polypus. As the disease progresses the general health breaks down, the patient becomes emaciated, the pulse quickens, and the appearance is that of one who is suffering from a wasting or painful disease.

The diagnosis in an advanced case seldom presents any difficulty; the finger, which is to be dipped in glycerine or in a mixture of soft soap and glycerine, comes upon an irregular ulceration of the cervix, or on a soft, friable, cauliflower-like mass. This latter condition is sometimes mistaken for a sloughing submucous fibroid, projecting through the os uteri, and which is to be differentiated by passing the finger upwards until its connection is made out. Such cases do not come within the scope of this work. In the early stage of the disease little may be felt except some slight hardness. On exposing the cervix with a Sims', not a Ferguson's, speculum, some increased vascularity will be noticed, with a swollen condition of the tissues; what discharge there is may be rather more like mucus than the ordinary watery fluid of the later stages. Should there be a doubt, a piece of tissue must be cut out; it is not sufficient to take a scraping from the surface. Sections are to be made of this tissue, and on thorough microscopic examination it is probable that a positive diagnosis can be made.

The symptoms of cancer of the body do not differ from those

of the same disease in the cervix. On examination the cervix may feel perfectly natural, the uterus, however, will be too large, and the diagnosis ought to be made by dilating the cervix, and exploring the whole of the cavity with the finger, when, if there be any doubt, a morsel of tissue can be removed for microscopic examination.

When the disease is diagnosed in any part of the uterus, and when the entire growth can be removed by vaginal hysterectomy, the sooner it is taken away the better. The general contra-indications to the operation consist in the state of health of the patient. If she be debilitated from some reason not connected with the malignant disease, or when some other serious disease, as for example phthisis, exists, the operation of hysterectomy ought not to be performed. Any fixing of the uterus or thickening of the broad ligament is to be looked on with grave suspicion. This condition ought not absolutely to veto the operation, for a case of cancer of the body of the uterus was seen in the end of 1883, when there was some slight fixation of the organ, accompanied by thickening in the left broad ligament, running apparently from a tear in the cervix. Under these circumstances the patient was not strongly advised to undergo the operation, and as she was not anxious to run the risk under the circumstances, the operation was not performed. Rather more than two years afterwards the disease was found to be still limited to the uterus, the hardness in the broad ligament being rather less than before.

Should the disease have spread from the cervix to the vagina it is hopeless to look for a permanent result by hysterectomy.

Vaginal Hysterectomy.

The operation of vaginal hysterectomy, though performed occasionally during the century, did not make any headway until about twelve years ago. The uterus was at first removed

through the abdomen, but the mortality was so great that this operation had to be soon given up in favour of the vaginal method. Occasionally cases are met with where a combination of those two operations will prove of service, as when a small fibroid tumour has become infected with malignant disease and where it cannot be removed *per vaginam.*

The preparations for the operation are simple, a dose of castor-oil and a thorough syringing of the vagina before the operation are all that is required, for it is useless to attempt to purify the vagina by injections given for some days before. The bladder is emptied, and the patient is placed in the lithotomy position. Clover's crutch is very useful to keep the patient steady, while it leaves the assistant with both hands free. No special instruments are required,—scissors, forceps, short curved needles and needle-holder, a sound, sponges, and sponge holders, a speculum, tenacula, two strong vulselli with catch, along with silk and catgut, being all that is necessary. Some operators find retractors useful.

The first thing to be done is to again disinfect the vulva, vagina, and cervix with a 1-500 solution of perchloride of mercury, the perinæum being drawn down so as to expose the whole of the canal. The ease with which the operation is performed will depend very much on whether the patient has borne children or not, a torn or flabby perinæum greatly facilitating the necessary manipulation. The cervix is firmly grasped by the vulsellum and is drawn down as far as it will come ; the vaginal mucous membrane is then divided round the cervix, keeping very free of the disease if that part be affected. The tissues are separated by clipping with scissors both in front and behind, care being taken to keep close to the uterus. If there be any doubt as to the position of the bladder, a sound may be passed, and kept in, if thought advisable. As the traction on the cervix prevents hæmorrhage, it is well to relax occasionally and tie any vessels which bleed. The peritoneum is first opened behind, and then in front. The curved needle carrying a silk thread transfixes

the lower part of the broad ligament, close to the uterus to avoid the ureters, and after being tied, the tissue is divided on the uterine side of the ligature; a second piece of broad ligament situated higher up is treated in the same way, and so on until the whole has been tied, and the ligatures cut short. If there be much bleeding from the uterus in spite of the traction, forceps are fixed on to the side of the organ. The other broad ligament is treated in the same way, and if possible the ovaries on both sides are removed. All bleeding vessels are tied, a small sponge is passed into the pelvic cavity to make sure that nothing has escaped into it, and as it is withdrawn the peritoneal edges are everted. It seems to be supposed that it is of little importance whether the peritoneum is closed or not, but sutures ought always to be put in. A drainage tube is not required. Iodoform gauze is packed into the vagina to keep everything sweet, and to give some support.

This is the most simple way of performing the operation, but several modifications may be mentioned. After opening the peritoneum behind and in front, the fundus is drawn downwards through the posterior opening, either by the help of a sound in the cavity, or by catching hold of the fundus with a vulsellum. By this manipulation the broad ligaments are brought lower down and are then transfixed and tied. The disadvantage of this plan is that the cervix passes more or less into the cavity of the peritoneum, and may possibly give rise to some septic infection, in spite of every precaution. Instead of tying the broad ligaments they are sometimes secured in specially arranged clamps, or in long and narrow-bladed catch forceps. These are left on for from twenty-four to forty-eight hours, and they are usually removed with considerable difficulty. The natural result is that the parts of the broad ligament slough and give rise to putrid discharge. This method is extremely simple and easy to perform, a finger being put in front of, and one behind the broad ligaments to act as a guide. It is bad surgery, and is resorted to only when

the operator is unable, or does not care to take the trouble to tie the ligaments.

The after treatment does not vary from that of any other abdominal operation, except that it is well to move the bowels early, to avoid intestinal adhesions forming to the cut surface of the peritoneum. The danger of this adhesion is, however, lessened when the wound has been accurately sutured.

In 1882, Dr. Keith removed a uterus by the vagina for epithelial cancer of the cervix. He thought of clamping the broad ligaments, but did not consider the idea a good one. The peritoneum was opened in front and behind, the uterus was drawn downwards, the broad ligaments were transfixed, tied, and divided on one side, leaving the ligatures on the divided ligament long. The other broad ligament was treated in the same way. The operation was a particularly easy one on account of the great mobility of the uterus and the almost total want of perinæum. It was completed by bringing the edges of the wound accurately together by ten stitches, and some gauze was packed into the vagina. The ligatures were drawn away from the broad ligaments with considerable difficulty at the end of two weeks. There has been no return of the disease.

In September 1890, the uterus was removed from a patient aged fifty for cancer of the cervix. The patient made a good recovery, but nineteen months after there was a slight return in the scar, accompanied by some bleeding, and a feeling of pelvic discomfort, scarcely amounting to pain. The patient was anxious to try something, but as the return had shown itself rather close to the base of the bladder an operation was not possible, and the injection of pyoktanin was suggested. The improvement in the general health under this treatment was very marked, the bleeding and discomfort disappeared, and at first there was rapid improvement in the local condition. At the end of three months there seemed to be some increase at one spot, and Dr. Mosetig was asked to come over from

Vienna to see the patient. He strongly advised the continuance of the treatment, and this was done by the patient's own medical man in Ireland, but it failed to check the disease. In 1891, an unmarried lady, fifty-two years of age, was seen. Menstruation had ceased for six years. For two years before there had been some irregular bloody discharge from the uterus. This was at first thought little of, but the patient gradually became emaciated and cachectic. On examination, the vagina was narrow, the cervix natural, the uterus slightly enlarged, and the discharge was very offensive. Removal of the organ was strongly advised, but was declined, as some friend had promised to cure the disease with the Mattei remedies. When next seen some six weeks afterwards, the uterus was much larger, and at the operation it was found difficult to bring down the enlarged organ through the narrow vagina. The operation would have been simplified by making an incision through the abdominal wall, and could have been finished much more quickly. The disease was entirely confined to the body, the cervix not being affected. The patient died on the second day. Her chances of recovery would have been much better had it not been for the time wasted, for the strength was diminished and the difficulty of the operation increased by the delay.

Displacements of the Uterus.

Displacement of the uterus must sometimes require to be treated by an abdominal operation when the patient is suffering, and all other treatment has been tried and has failed. Retroversion and prolapse are the conditions which may require such treatment.

It is not necessary to enter into the symptoms caused by a retroversion, and it is very seldom that the operation ought to be required when there is no accompanying disease of the uterine appendages.

The operation is not suitable for all cases of prolapse, only for those where there is little rectocele or cystocele. The diagnosis of the exact condition is made by pushing the uterus into the normal position, and preventing its descent with the finger, while the patient bears down. Should the pelvic contents not come down the case is one suitable for abdominal operation.

The operation for both these cases consists in making a short median abdominal incision, and fixing the uterus to the abdominal wall. This is done in various ways, the best is to make an artificial pedicle with the right broad ligament, clamp it with an ordinary ovariotomy clamp below the ovary, and fix it in the wound, the ovary of course being removed. Should the patient be near the menopause, the left ovary may also be taken away and the stump allowed to drop back into the abdominal cavity. Examination made shortly after the operation shows that the uterus is fixed, but after a few months it becomes completely movable and never reverts to its old position. The first operation we know of was performed by Dr. Keith in 1869. The following is a good example. A lady twenty-six years of age had been under the treatment of several of the best specialists in America, but had received only temporary benefit. When she saw Dr. Keith in 1880, he found that the uterus was large, heavy, and retroverted, and that the ovaries appeared to be healthy. The lady could do almost nothing on account of pain in the back. Dr. Keith sent her home to rest for a year. She returned after two additional years of treatment. Both ovaries were removed, and the pedicle of the right was fixed in a clamp to the abdominal wall. The patient got quite well, and there was no return of the pelvic trouble up to her death, which occurred eight years after the operation.

A patient forty-eight years of age had suffered from constant pain in the right side since the birth of her first child eleven years before; the pain and discomfort were so

great that she found life a burden. Almost the whole of the uterus lay outside the vagina, and there was little prolapse either of the bladder or rectum. The right ovary and tube were enlarged. At the operation in April 1886, the left ovary, although it was healthy, was removed on account of the age of the patient; the pedicle of the right ovary and tube was fixed in a clamp. The clamp came off at the end of the third week, but the patient was not allowed to get out of bed for an additional fortnight. Four months after the operation she was perfectly well, and able to walk a long distance. When heard of in 1892, six years after the operation, there had been no return of the prolapse.

Instead of fixing the uterus up to the abdominal wall by means of the broad ligament, various other plans are adopted; the median incision is made as before, a silk suture is passed beneath the round ligament close to the uterus and then through the peritoneum and is tied; a second suture fixes the other round ligament to the peritoneum in the same way.

The uterus may be sutured directly to the peritoneum, or, in cases of retroversion alone, the anterior part of the uterus and the anterior surface of both round ligaments are scarified, the parts over the round ligament being folded across and on to the uterus, and in this position they are stitched together. A pucker may also be made in the round ligaments. The objection to all these plans is, that in time the uterus almost always breaks away, and the old condition of affairs returns. To make the operation justifiable the mortality must be almost nil.

Obstruction to Labour.

Obstructions to the passage of a child through the pelvis are seldom so absolute in this country as to make it necessary to resort to a cutting operation. When the maternal outlet is so small that it is impossible to extract even a mutilated child, one of four operations will have to be resorted to. The causes which

necessitate the performance of any of these operations are, either a contraction of the bony walls of the pelvis from malformation or from the presence of a tumour growing from the bones, or a diminution of the space required for the passage of the infant by a fibroid tumour of the uterus, or cancer of the cervix, or even by simple swelling in the pelvic cellular tissue. It is considered that anything under an antero-posterior diameter of one inch and a half with less than three inches in the transverse diameter necessitates surgical interference. It is quite an open question whether it would not be better and safer for the mother to operate when the diameter is two or even two inches and a half, rather than to perform craniotomy.

There are four operations: the Cæsarean, or the extraction of the child through the wall of the uterus.

Porro's operation, or the removal of the uterus with the child.

Laparo-electrotomy, or the extraction of the child through the natural os and through an incision made into the top of the vagina from the outside above Poupart's ligament.

Symphysiotomy, or the old operation, recently revived, of dividing the pelvis through the pubic symphysis so as to increase the space and allow the extraction of the child *per vias naturales.*

The choice will depend partly on the nature of the case, and partly on the experience of the operator. It will be seen that either of the first two may be resorted to in any case, while the field for laparo-electrotomy and symphysiotomy is to a certain extent limited.

At full term the uterus will be found to have raised and stretched the broad ligaments to a great extent, and the condition is somewhat the same as that of a fibroid tumour of the uterus which has grown between the layers of the broad ligaments. The entire pelvic peritoneum is raised so much that an incision made immediately above the pelvic brim is below the level of the peritoneal cavity, the base of the broad ligaments being higher than the upper borders were before the commencement

of pregnancy. The upper border, which in the unimpregnated condition has an almost horizontal direction, has now become almost vertical, running from the side of the fundus of the uterus to the brim of the pelvis. The cellular tissue becomes loose and allows of considerable movement and stretching of the broad ligaments.

Cæsarean Section.

The Cæsarean operation is the extraction of the child through an incision in the uterus. No special instruments are required for its performance, a bistoury and a needle and thread will suffice; in addition, a pair of scissors, catch forceps, and sponges will be found useful. Two assistants are required in addition to the anæsthetist. Before commencing the operation it is well to make out the position of the head, and to assure oneself that the infant is living.

When a choice of the time for operation can be made, it should be arranged for at full term, as near the commencement of labour as possible, and before the membranes have ruptured.

It is impossible to give exact directions as to the position of the median incision through the abdominal wall, it must be made entirely in regard to the situation and size of the uterus, keeping in mind that the section of that organ is to extend downwards from close to the fundus. The external incision may therefore be partly above and partly below the umbilicus, or might even be wholly above; in length it will vary from four to six inches, depending on the thickness of the abdominal wall. The incision ought to be carried right through the umbilicus, and here, as also when large solid tumours are being removed, it assists greatly in the accurate stitching of the wound if one or two lines are made across the linea alba with an aniline or nitrate of silver pencil, the latter being the better. After the peritoneum has been opened to the full extent of the wound, it is necessary to be quite certain that the uterus is not twisted upon itself, and this is effected by inserting the finger and

making out the position of the Fallopian tubes. One assistant then presses the uterus well forwards from the outside so that there cannot be any escape of blood or fluid into the peritoneal cavity, and an incision of from one to two inches is made through the middle line of the uterus, commencing close to the fundus. The thickness of the uterine wall to be divided will probably be at least one inch, and the incision may be made to that depth with the first cut. As soon as the membrane is reached—and its white glistening appearance is unmistakable—the incision is to be extended downwards with scissors to the extent of about four inches, the exact length of the wound depending on the size of the child. The making of the uterine incision and the extraction of the child must be done quickly, and it is not necessary to spend more than a couple of minutes in completely emptying the uterus from the time of commencement of making the skin incision. It is therefore of little importance whether the membranes are ruptured or not. If the incision be completed without rupture of the membranes, the head is grasped through them, and they are ruptured during the extraction of the child; on the other hand, should the membranes be broken before the incision is finished, it is to be at once completed, and the hand passed into the uterus quickly extracts the child by the head. It is best to seize the head and not endeavour to deliver by the feet, for if the uterus contract very rapidly or the surgeon be not quick enough in his manipulation, the after-coming head may be grasped by the contracting uterus. As the child is withdrawn the collapsed uterus is pushed forward by the assistant, who has been making steady pressure from the loins, and the upper and lower halves of the uterine incision are grasped by the right and left hands of the other assistant. This plan is immensely superior in every way to attempting to arrest the hæmorrhage by constricting the neck either with the hands or by a ligature. In this way bleeding is entirely arrested. As soon as the child has been delivered the cord is temporarily constricted by two pairs of forceps and is divided between them. The infant is

handed over to the nurse, who ties the cord in the usual way. A large sponge is inserted into the upper part of the abdomen to shut off the peritoneal cavity from all exposure, and the hand is passed into the uterus to remove the placenta while the assistant slightly relaxes the wall.

Sponging ought not to be necessary, but if required it must be done at this stage. A part of the uterus will now be lying slightly outside the abdominal cavity, and it is not necessary to draw it farther than is required for convenience in stitching; turning out the whole uterus before the child has been extracted, or at any other stage in the operation, is entirely unnecessary. The stitching of the uterus is begun, the peritoneal covering

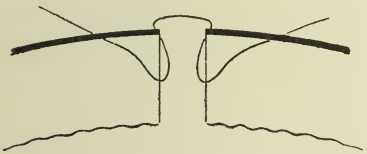

Fig. 33.

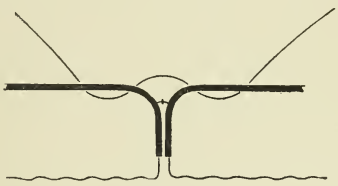

Fig. 34.

being turned inwards, and if there be any difficulty in doing this, it may be slightly dissected off. A single needle threaded with silk is used, and each stitch is tied as it is introduced, no clots being allowed to remain between the lips of the wound. Before the stitches are introduced into the uterus, the finger must be passed into its interior to be certain that the cervix is open, and if necessary it must be slightly dilated. Three deep stitches are required to the inch, and if necessary, superficial ones also may be put in. The stitches are to be passed deeply into the substance of the uterus without entering the cavity, and care must be taken to avoid the common mistake of tying them too tightly. After all the stitches have been secured, the sponge is taken out, the uterus dried, and the abdominal wall closed with a large number of sutures. Drainage of the peritoneal cavity is not required, and the after treatment is conducted on general principles.

Various plans have been adopted for closing the uterine wound, and one other may be given. The deep stitches, two to the inch, are introduced a quarter of an inch from the edge of the wound, and are passed through the uterine muscle as before, taking care not to enter the uterine cavity. After they have been tied a superficial silk stitch is introduced between each. The peritoneum is picked up by a stitch half an inch from its now turned-in edge, on the one side, and at the same distance on the other; as these stitches are tightened, the peritoneum is inverted over the deep sutures which are thus completely buried.

If the uterus does not contract well, a sponge or two wrung out of hot water may be introduced into the cavity, or a dose of ergot injected hypodermically may be given, this latter being always good practice as soon as the child is extracted, or simple kneading may cause contraction, or the use of the galvanic current may be necessary. Should contraction not take place Porro's operation would be required.

Before commencing a Cæsarean section, one has to make up one's mind on the question of whether future pregnancies are to be allowed or not. It is a difficult question to decide what is the proper course to follow; if the patient be willing to run the risk of operative interference a second time the matter is settled, and on the whole it will be best to be guided by her wishes on the subject. Whether the ovaries are to be removed or an excision made of a piece of the Fallopian tubes will depend on the age of the patient; for the artificial menopause which results from the removal of the ovaries gives rise to many distressing nervous symptoms.

Porro's Operation.

Porro's operation is the removal of the uterus either in its entirety or at the neck. It is to be performed when there is cancer of the uterus or a large fibroid tumour, and under similar pelvic conditions as the Cæsarean section. The first steps of the operation are the same, the uterus may be incised and the child

extracted, or the abdominal incision may be made longer and the uterus turned out whole. If the child be extracted when the uterus is in the abdominal cavity, it is not necessary to wait for the separation of the placenta, but the uterus is drawn outside at once. This is done by hooking a finger into each end of the uterine wound and pulling, while the assistant pushes from behind. As soon as the uterus is turned out some sponges are packed into the abdomen and a ligature is quickly tied round the neck; a clamp or wire is fixed on, as in supra-vaginal hysterectomy, or the broad ligaments are enucleated downwards, and the whole of the uterus removed. In either case the steps do not differ in any detail from the description given in the chapter on the treatment of uterine fibroids. Instead of removing the child *in situ*, it will be better to turn out the uterus, quickly tie an elastic ligature round the neck and cut it off. The assistant opens the uterus and removes the child. The advantages of turning out the uterus entire are, the prevention of fluid escaping into the peritoneum, and of the loss of blood which occurs when an incision is first made. The disadvantage is the longer abdominal incision. The stump is either fixed in a clamp, or the cervix is enucleated as before. There is nothing peculiar in the after treatment.

Laparo-Electrotomy.

The next operation, that of laparo-electrotomy, differs from the other two in that neither the peritoneum nor the uterus is opened. The object of the operation is to extract the child above the brim of the pelvis. Before the operation is commenced the os must be dilated either naturally or with Barnes' bags. When there is difficulty in doing this on account of the position of the os or contraction of the vagina, it can be done at a later stage through the incision.

The extraction is accomplished by making an incision in one or other groin, reaching from one and a half inches to the outside of

the spine of the pubes to one inch above the anterior superior iliac spine. It runs with a slight curve, the concavity looking upwards, about one inch above Poupart's ligament, and may be made on either side, the right being the more convenient. The epigastric artery is the only vessel of any size divided by the incision. On getting near the peritoneum, it may bulge into the wound, and must be kept out of the way by the assistant. The vagina is opened as low down as possible to avoid the large veins which are present near the cervix, and also to keep clear of the ureters. Until the vagina is opened, a sound should be kept in the bladder to avoid injury of that viscus, though such an injury is more likely to occur during the extraction of the child. The vagina is to be pressed up into the bottom of the wound by the finger introduced into the passage, and an opening is made from the wound on to the finger with scissors. The opening is enlarged by tearing, and the child is delivered either by forceps or by turning through the upper part of the vagina and the abdominal wound, thus entirely avoiding the pelvis. The placenta is extracted in the ordinary way. There is not much trouble from bleeding; any vessels may be tied, and should there be persistent oozing which does not stop after the stitches have been introduced and tied, the vagina must be packed with iodoform gauze and pressure made against that. Before closing the wound a weak solution of permanganate of potash is injected into the bladder, and if there be any injury to that organ it must be closed at once. The stitches are introduced as in any abdominal wound, and the dressing is the same as usual. A bladder opening has shown itself some days after the operation, but no harm has been known to result, and operation has not been required, as the fistula has healed in a few weeks.

This operation has not been performed at all frequently, possibly because the description appears to imply that great surgical skill and anatomical knowledge are required.

Symphysiotomy.

Recently the old operation of division of the symphysis pubis has been revived. The possibilities of this operation are limited to those cases of diminished pelvic outlet where the conjugate is not less than two and three quarter inches, and it is therefore a question whether the operation ought to be resorted to rather than the induction of premature labour. This is, however, a point which must be decided by the obstetricians, and it is only necessary here to describe the indications for the operation and the mode of its performance.

It has been found, that when the cartilage at the symphysis is divided in a woman who has died during labour, the two bones may be separated fully two inches without causing any injury.

Dr. Harris of Philadelphia gives the following directions for the applicability of this operation:—"As the fœtus is to be delivered *per vias naturales*, great care must be taken to get a proper measure of the sacro-pubic diameter of the pelvis, and to determine if a normal condition of the sacro-iliac symphysis exists. The operation is not practicable in a Robert or Naegele pelvis, or in one where there is a coxalgic ankylosis from disease in childhood. It is also impracticable in cancer of the cervix uteri, in cases where the cervix will not dilate, and in obstructions of the pelvis by exostoses, cervical and sacral tumours, and other forms of abnormal growths. It should be borne in mind that the shorter the sacro-pubic diameter the greater must be the strain on the sacro-iliac symphysis, and that the pubic separation, when the fœtal head is large, will be much greater than when it is small; a large cranium has to occupy deeply, with one parietal protuberance, the inter-pubic opening. If rachitic dwarfs bore children of a size in proportion to themselves there would be less difficulty in their delivery; but the fœtus is often influenced by the size of the father, who may be a large man, and it will weigh from 8 lbs. to even 14 lbs."

The only special instrument which is advisable is a Galbiati's

probe-pointed bistoury, but a strong, probe-pointed, curved bistoury will do instead. The pubes must be shaved in this operation alone of all abdominal operations and the parts about the vulva must be disinfected by the surgeon with the very greatest care. The patient is placed on the back with the knees drawn up and separated as far as possible, and a rigid catheter is passed into the bladder and is given in charge of an assistant to depress the urethra and draw it to the side, and thus prevent its injury when the section is made. A vertical incision is made through the skin and superficial tissues, about two inches in length, the lower end being rather less than an inch above the symphysis pubis. The incision is deepened with scissors down to the symphysis in the direction of the notch, which can be easily felt at this stage if there has been any difficulty before the skin was divided. The bone having been reached, the left forefinger is passed down behind the symphysis, the palmar surface lying against it. Galbiati's knife is passed along the finger until it hooks round the lower part of the symphysis, which it cuts in a direction from within outwards, and from below upwards. As soon as the division is made, the bones are at once separated. If the assistant is not very careful in keeping the urethra well depressed, and to the right side while the symphysis is being divided, the canal runs a great risk of being injured. The wound is temporarily dressed, while the child is being extracted. While this is being done an assistant must prevent too great separation of the pelvis. The wound is closed with the usual silk sutures, and a bandage is put firmly round the hips to keep the pelvis absolutely quiet. The tendency appears to be to allow the patient to get out of bed too soon. It seems to be a mistake, however, to run the risk of any movement of the pelvis by permitting the patient to get up at the end of a week, although it appears to be customary to treat the cases very much as if no operation had been performed.

In considering the question of which of these four operations is to be performed, it is necessary to take into consideration all

the circumstances of the case, and there is no one operation which can be recommended under every condition. The scope of symphysiotomy has already been referred to. Its application is limited, and it cannot be of service when the contraction of the pelvis is great.

Symphysiotomy and laparo-electrotomy may be first compared, as in neither is the peritoneum opened. With the small experience there has been of laparo-electrotomy it appears that this operation is to be preferred. Neither can be chosen when there is cancer of the cervix, nor when there is a fibroid tumour of the uterus preventing labour, for in the first case no cure can be obtained by the operations, and when a fibroid is present an abdominal operation can cure the disease at the same time. They cannot be used by those who consider it unjustifiable to allow a woman with a pelvis contracted from one cause or another, to run the risk of future pregnancies. It is said that laparo-electrotomy cannot be performed oftener than twice on the same patient, first on one side and then on the other, but it is difficult to understand why this should be so, although one can easily see that there might be some extra difficulty in making the incision. The advantages of both are, that there is little loss of blood, and that the peritoneum is not opened. The disadvantages are, that they are not suitable for every case, that there is risk of injuring the bladder by tearing as the child is delivered, or the urethra during division of the symphysis, and that future impregnations cannot be prevented should this be desired.

Comparing the two intra-peritoneal operations the preference will be given, as a rule, to the Cæsarean section. It is certainly more easy to perform than the Porro, and the risk to the patient is very much less. It allows of future pregnancies, the operation having been performed several times on the same patient, and there is not the inconvenient stump to be dealt with, as in the case of the Porro, when performed in the usual way. It will be preferred except in cases where there is inertia of the uterus, where there is a large fibroid, and in cases of cancer of the

cervix when the uterus and the whole of the disease can be removed.

Each case must be treated by the operator in the way which appears to be most suitable under the circumstances, and it is probable that the Cæsarean section will become the operation of election. The child may be allowed to suckle if the patient be delivered at full term, and in every other respect the treatment to be followed does not differ from that of a usual confinement.

Rupture of the Uterus.

Complete rupture of the uterus is an accident which fortunately does not occur frequently. It is usually caused by some weakness in the muscular wall of the uterus, due to obstruction to the passage of the child, the result being that the lower segment of the uterus is drawn up into the abdomen and thinned out; or by some external injury during pregnancy; or by some injury during an attempt at delivery, either by the hand while turning, or with the forceps. Strangely enough the symptoms are not always well marked, but as a rule there are signs of collapse and hæmorrhage; there may be sudden and severe pain, and on examination the part which was presented will usually have disappeared. Hæmorrhage from the vagina frequently occurs. The patient feels as if something had given way, and the noise made by the tear is at times heard by those present in the room. The symptoms may not come on immediately. If the hand be passed into the uterus, it may be found that the fœtus has partly or wholly passed into the peritoneal cavity, or the uterus may be found to be contracted, showing that the fœtus has disappeared through a rent.

When the accident has occurred, an incision into the abdominal cavity through the middle line must always be made, for to do nothing means death. Both the fœtus and the placenta must be removed if they have passed into the peritoneal cavity. The rent in the uterus must be looked for, and it will usually be

found at the lower part ; a rupture at the fundus is rare, for as the uterus contracts the walls of the upper part thicken, while the lower zone is stretched and thinned. On account of the usual position of the tear, and also from the irregularity and bruising of the edges, it is seldom possible to repair the rent, and the whole organ must be removed. This is done in the way described under Porro's operation, the abdomen is well washed out and sponged, care being taken to dry the pouch which is formed behind the pubes. A drainage tube is to be left in, and the wound is closed.

Extra-Uterine Pregnancy.

The proper and natural resting-place for a fœtus during the whole nine months of pregnancy is in the cavity of the uterus. When the fœtus is situated outside this cavity, the pregnancy is said to be extra-uterine, and this describes the condition exactly. The desire for the manufacture of new names has led to the adoption of a new term to describe the abnormal position, and the phrase, ectopic gestation, is often used. It matters nothing to the patient what term is employed, and we shall continue to use the old name as comprising every case of pregnancy outside the uterine cavity. The great majority, if not all, of these cases, occur primarily in the Fallopian tube. There is still a certain amount of doubt in regard to the question whether the impregnation may not occur in the ovary. During an operation, and especially when bleeding is going on freely, one has to think rather of the patient than of the exact pathological condition, and observations made at the time require corroboration not only by examination of the specimen removed, but also it may be from *post mortem* examination. Opportunities of making exact observations during a *post mortem* examination are fortunately not often met with, and this may account in part at least for the doubt which surrounds the question of ovarian pregnancy. It is quite possible to see how it may occur, but it

may be that an ovary or small ovarian tumour forms part of the sac, the remainder consisting of the fimbriated end of the tube which has become adherent. In any case it is not of practical importance. While it is at least probable that every case of extra-uterine pregnancy commences in the tube, the fœtus does not remain in that position long, rupture occurs, usually before the third month, either into the abdominal cavity or between the layers of the broad ligament. When the fertilised ovum is arrested in the tube as it passes through the uterine wall, the fœtus may grow in that situation until the end of the pregnancy, and apparently the child may be delivered naturally; or rupture may occur about the fifth or sixth month.

The rupture may take place in one of two directions. It may be either through the part of the tube which is in direct contact with the peritoneal cavity; or through the part which lies between the layers of the broad ligament, and thus in direct connection with the cellular tissue of the pelvis.

When the rupture is through the part of the tube in direct communication with the peritoneal cavity, the fœtus passes directly into the abdomen. The result of this is, either that the patient dies of hæmorrhage; or the fœtus dies and disappears in the intra-peritoneal hæmatocele resulting from the bleeding; or the fœtus lives, forms an adventitious sac, goes on to full time, dies, becomes formed into a lithopædion, and may eventually be got rid of either through the abdomen or any of the abdominal viscera.

When the rupture takes place in the part of the tube situated between the layers of the broad ligament, the fœtus passes into the cellular tissue, and if it die early it disappears in the extra-peritoneal hæmatocele which is formed. If the pregnancy be further advanced, the fœtus does not disappear, but is apt to cause suppuration. If it live in this situation it may go on to full term and eventually dry up into a lithopædion. If a second rupture take place from the interior of the broad ligament into the peritoneal cavity, the results are similar to

those which occur when the rupture into the peritoneal cavity has been primary instead of secondary.

Symptoms.—It is seldom that one has an opportunity of diagnosing an extra-uterine fœtation before rupture of the tube has taken place. There is nothing to make the woman suspect that there is anything the matter, and she may have no idea that she is pregnant. This is not to be wondered at, for these cases occur as a rule in women who have been sterile, or who have not had a child for some time. There is frequently some previous history of pelvic trouble, and the most likely symptom to draw attention to the condition is irregularity in menstruation combined with some of the usual symptoms of pregnancy. A cast of the uterus is probably always thrown off, but may not be noticed by the patient. On examination the uterus is found to be enlarged, and to be pushed either forwards or to one side by a soft well-defined oval swelling. In the region of this swelling and running towards the uterus marked pulsation is felt. The swelling differs from an ordinary pyo- or hydrosalpinx in conveying the feeling that something has been inserted into the tube at one spot. There is no special tenderness.

When the rupture takes place through the part of the tube in direct communication with the peritoneal cavity, alarming signs of hæmorrhage may be the first and only symptom. The hæmorrhage may be so great that the patient may die simply from the loss of blood. When the patient is seen the signs of hæmorrhage are well marked. She is cold, collapsed, restless, and anæmic. On examining the abdomen the presence of fluid may be detected, or an ill-defined swelling may be present. In the pelvis there may be nothing definite, simply some slight bulging, and more than the ordinary amount of resistance. Although the condition is most alarming, the patient does not necessarily die.

When the child lives in the abdominal cavity it becomes surrounded by a sac, although in one notable case the fœtus was

simply lifted out from amongst the intestine when the abdomen was opened. The diagnosis of the presence of a fœtus outside the uterus is extremely difficult, and reliance must not be placed on the apparent want of the uterine wall, for in cases of normal pregnancy it is not uncommon to feel the fœtus lying apparently immediately beneath the abdominal wall. The main points to guide us are the history of the attack when the rupture occurred, the irregular uterine discharge, and the cast if it be obtained. The examination shows a body in the position of the uterus, which organ is somewhat enlarged, partly fixed, and is not in its natural position. The sound must not of course be passed if there be any suspicion of pregnancy.

When the tube ruptures into the broad ligament, and a rupture into this situation or into the abdominal cavity usually occurs while the patient is making some slight exertion as putting on her clothes, great and sudden pain is experienced in the lower part of the abdomen. If there be much hæmorrhage into the broad ligament the pain will be of a tearing character, and there may be collapse with the usual signs of the loss of blood. An examination made at this time or shortly afterwards will show the uterus much as before, but the lateral swelling will not be so defined. The swelling will be much larger than it was, pulsation will be evident, and the mass will be decidedly tender to the touch.

If the fœtus be absorbed the swelling which is practically a hæmatocele in the broad ligament quickly disappears.

Should the fœtus be too far advanced to allow of its absorption, suppuration may occur, and from the anatomical relations of the pelvic cellular tissue it will be seen that rupture will take place, into the rectum, vagina, bladder, or through the abdominal wall, the fœtal bones being discharged among the débris. Before this rupture takes place symptoms may be noticed, there may be vesical irritability if the abscess be going to open into the bladder, or diarrhœa or tenesmus if the rectum be the site chosen.

When the fœtus lives after the tube has ruptured into the broad ligament, and has not passed into the abdomen through a second rupture, it continues to grow, and if left alone goes on to full term. There is then an attempt at labour, the uterus which has become considerably enlarged contracts and causes spurious labour pains. The fœtus soon dies, the amniotic fluid is gradually absorbed, and the placental circulation diminishes and finally ceases. These phenomena are accompanied by diminution in the size of the swelling. In time the fœtus becomes disorganised and is transformed into a lithopædion. This may lie quiescent for many years, but may at any time begin to discharge itself through the abdominal wall or any abdominal organ.

When secondary rupture of a living fœtus takes place from the broad ligament into the peritoneal cavity the hæmorrhage will be severe. If the fœtus die and is too far developed to be absorbed it becomes encysted, and the sac may rupture into any abdominal organ.

When the fœtus lives, and it is more likely to do so than when it has passed into the abdomen after a primary rupture of the tube, because it is in that case usually older, the after history is the same as already described.

When an adventitious sac has been formed, there is practically no difference from the case of a fœtus enclosed in the expanded broad ligament, except that the opened-up broad ligament raises the uterus into the abdomen, and when rupture occurs the contents are more likely to pass in the direction allowed by the anatomical relations of the cellular tissue.

Treatment.—If a diagnosis of tubal pregnancy be made before rupture, treatment is of the simplest, and removal of the tube should always be advised. Of the less heroic methods of treatment, electricity is the only one which has been at all successful. But as the abdominal operation must be invariably preferred, it is unnecessary to describe any of the other methods which have been used.

The abdominal incision is made as usual in the middle line; as soon as the fingers reach the uterus they are passed outwards and immediately come on the swelling. This is gently brought up to the wound, and the broad ligament below it is transfixed and tied. The operation need not last more than a few minutes. Before the wound is closed the ovary and tube on the other side are to be examined, and if unhealthy must be removed. When the rupture has taken place directly from the tube into the peritoneal cavity, immediate operation is called for, on account of the danger due to hæmorrhage, which seems to have little tendency to cease. Whenever this diagnosis has been made, nothing must be allowed to come in the way of immediate operation. To see a patient in the evening and to fix the time of operation for some hour next morning is a practice which is impossible to understand, though it is sometimes done. In the hurry of an operation performed at a moment's notice some precaution is apt to be omitted. While no unnecessary delay can be allowed, a few minutes may be devoted to the thorough cleansing of the abdomen, and also to procuring several hot bottles with which to surround the patient during the operation, as the sudden loss of blood will have made her specially liable to chill.

The incision two or three inches in length is made through the wall, and the fingers are at once passed down to the uterus and along one broad ligament. If it be healthy the other one is drawn upwards, is ligatured as close to the uterus as possible, and the ovary and tube are removed. The tissues are friable, and the ligature must not be unnecessarily fine. Having in this way stopped the bleeding, clots of blood are to be removed from the cavity, and the best way of doing this is by thorough washing out with warm water. It is well to leave in a drainage tube for twenty-four hours. The after treatment resembles that of any abdominal operation when the patient is much debilitated. A moderate amount of stimulants will be required, and copious rectal enemata of warm milk and thin soup will be quickly absorbed. When the operation has been performed after a large

quantity of blood has been lost, transfusion may be required. When the fœtus has passed between the layers of the broad ligament, the symptoms of hæmorrhage are not so marked, and it is not likely that there will be any cause for immediate operation. The patient must be kept absolutely quiet in bed with the extremities warm, and the pain should be relieved by injections of morphia. If no urgent symptoms supervene, and the growth be not increasing in size, time may be given to see what nature will do. If the swelling be enlarging no time should be lost in advising its removal. In this case we can choose on what day or hour of the day the operation is to be performed.

The operation is not so simple as when a primary rupture of the tube into the peritoneal cavity has been dealt with, as the fœtus has to be removed by enucleation from the broad ligament, and bleeding is likely to be free. If it be impossible to ligature the base of the broad ligament below the bleeding, the sac formed by the opened-up folds of the broad ligament must be stitched to the abdominal wound if possible, and the cavity plugged with iodoform gauze. If this cannot be done, and if the hæmorrhage cannot be arrested by the pressure of sponges wrung out of hot water, gauze must be packed into the pelvis, even although this is a most unworkmanlike and unsurgical proceeding. When the sac is large enough to be seen through the abdominal wound, the position of the placenta may be noticed, and if so it should be avoided if possible. When a secondary rupture occurs from the broad ligament into the abdominal cavity, the treatment will be similar to that adopted when the rupture in this position has been a primary one. Immediate operation is almost certainly called for.

When the fœtus grows in the abdominal cavity, opinions differ as to whether it is better to operate early, or to allow the pregnancy to go on until the child is viable and remove it then. The safer plan is to remove the fœtus as soon as the sac can be fixed to the abdominal wall.

The operation is by no means a difficult one. The

peritoneum is opened, the sac is aspirated after sponges have been packed round if much fluid be present, and it is then laid freely open. The fœtus is removed, the cord tied, and the sac stitched to the abdominal wall. The placenta is not to be interfered with. A rubber drainage tube is left in, or the cavity is packed with gauze should the placenta have been injured. When the patient progresses satisfactorily, the gauze may be left in for ten days or a fortnight, and must be removed with extreme caution, as the hæmorrhage which may occur when this is being done may be of a most alarming nature. Within a second blood may be pouring over both sides of the abdomen, while a third stream is flowing over the pubes, and it is well to have some fresh gauze at hand with which the cavity can be again plugged.

When suppuration follows death of the fœtus in the broad ligament, the treatment will be similar to that of ordinary abscess in that position.

Pelvic Hæmatocele.

A pelvic hæmatocele is a collection of blood in the pelvis. More commonly it is situated in the pelvic cellular tissue and is thus extra-peritoneal, or the hæmorrhage may have taken place into the peritoneal cavity and be thus intra-peritoneal. The first class is caused by a primary rupture of an extra-uterine fœtation into the broad ligament, or by the rupture of a vein in any part of the cellular tissue.

The second variety is caused by a reflux of blood from the uterus and Fallopian tubes, the rupture of an extra-uterine fœtation into the peritoneal cavity, or the rupture of any dilated blood vessel, resulting usually from an injury.

The immediate danger of an extra-peritoneal hæmatocele is much less than when the rupture has taken place into the peritoneal cavity, as in the first case, the pressure of the tissues as they distend tends to arrest the flow of blood.

Symptoms.—These are due to the loss of blood, and in the extra-peritoneal variety there will also be pain of a severe tearing nature. On examination the signs will resemble those already described under extra-uterine pregnancy.

Treatment.—This consists in absolute rest in bed, in the application of warmth to the feet and cold to the abdomen, and in the injection of morphia if necessary. The majority of cases do not require any further treatment, if the patient be careful to avoid getting a chill until the swelling has disappeared. In a certain number of cases where the hæmorrhage is so great that the life of the patient is endangered simply by the loss of blood, and where it is apparent that the hæmorrhage is still going on, the abdomen must be opened without delay.

When the blood is not absorbed, and suppuration supervenes, the treatment will be similar to that of any pelvic abscess.

Pelvic Abscess.

A collection of pus in the pelvis results from an acute attack of pelvic inflammation, it may also follow extra-uterine pregnancy or hæmatocele, or it may be connected in some way with the Fallopian tubes.

The pus usually burrows between the rectum and vagina, and it may open into one, more frequently into both, of these passages; or it may pass upwards outside the peritoneum and point in the groin, but its exact direction will depend on its relation to the anatomical structures of the pelvis.

Symptoms.—The symptoms are usually those of an abscess elsewhere, combined not infrequently at the commencement with the passage of large quantities of mucus from the rectum. Sometimes pelvic suppuration gives rise to very slight symptoms.

If the pus approach the bladder there may be symptoms of irritation, and if it open into the bladder these symptoms will be much aggravated.

Pelvic examination may show nothing but a general matting

together of the tissues, or a distinct fluctuating or boggy swelling may be felt, and the exact situation and position of the uterus will depend on the size and position of the abscess.

Treatment.—When pus is present the sooner it is evacuated the better, and the position of the incision will depend on the size and position of the swelling. When it can be easily reached from the vagina it ought always to be opened from below, when it lies beneath the abdominal wall the incision must be made from above. In a doubtful case the better plan is to open the abscess in the way which will allow of the most satisfactory drainage.

When the abscess has resulted from the suppuration of a collection of blood inside the peritoneum, the symptoms and treatment will not differ from those already described.

Such cases may occur in men as well as in women.

Heart-Clot

Any of the usual surgical accidents, as for example tetanus, may follow on an abdominal operation. There is one, however, about which little is known, which may be specially mentioned, more especially as the result does not seem to be so fatal as is usually supposed.

In giving a prognosis in even the simplest of abdominal operations, accidental risks have to be borne in mind, and we are thus prevented from describing even an exploratory incision or the removal of a non-adherent ovarian tumour as an operation entailing absolutely no risk.

The special accident referred to is that known as heart-clot.

This accident, the exact causation of which it is difficult to explain, is without exception the most distressing which can happen. A hæmorrhage is due to a want of care or a want of skill on the part of the operator, and he knows that the prevention of such an accident lies with himself, but when a

patient dies after a heart-clot the operator has no guarantee that a similar accident will not occur after his next operation. He does not know the cause of the accident, he consequently does not know how to prevent it, and the patient may be dead even before a messenger can be sent for him. He may have seen the patient in perfect health only a few minutes before, and the next he hears is that death has come without a moment's warning.

The usual history is that the patient, who has been doing well, and who is considered to be completely out of danger, suddenly and without warning, somewhere about the tenth day, starts up, struggles for breath, and without even being able to speak, may be dead before the nurse can reach the bed. The usual impression seems to be that the patient almost invariably dies.

In our own experience, taking in addition all of Dr. Keith's cases, this accident has happened five times, two only of the patients having died. Of the two fatal cases one is referred to under the operation of hysterectomy, the patient dying almost without waking on the ninth day, the other happened after a comparatively simple ovariotomy. No trouble followed the operation, and about four o'clock on the morning of the tenth day, the patient started out of her sleep, was able to call out for air, and died, the nurse thought, in about two minutes. Instead of giving the symptoms common to cases which recovered, it seems better to describe minutely one of these cases, and to refer to the other two where they differ in any way. A patient was sent home from Gibraltar in March of this year, the presence of an ovarian tumour having been diagnosed. On examination a multilocular non-adherent ovarian tumour was found, and at the operation performed on the 19th of March the tumour and a small cystic enlargement of the second ovary were removed, the pedicles being ligatured. A large vein which ran across the wound had to be divided, one end being ligatured with catgut. The operation lasted barely twenty

minutes. The progress of the patient was completely satisfactory, and the stitches were removed at the end of a week, the wound being perfectly dry. Early on the morning of the 23rd, three and a half days after the operation, the patient twice complained of a feeling of chilliness down the back. On the 28th (tenth day) she was seen about four o'clock in the afternoon, and was found to be perfectly natural and well. Suddenly, about 5.30, she gave a cry, put her hands over her heart and her breathing became rapid and grasping. The nurse said that she was completely collapsed, no pulse could be felt, the surface became deathly cold, the face became ghastly white and the lips purple. Brandy was given very freely, the patient was surrounded with hot bottles, and a mustard plaster was put over her heart; as soon as she could speak she complained of great pain and a feeling of tightness across her chest.

She was seen at 6.15. She was then restless, was throwing about her arms, the voice was weak, the face was deeply cyanosed and pinched, an occasional pulsation was felt at the wrist, the heart sounds were faint and between 140 and 150. The whole surface of the body was cold and the breath very markedly so. The breathing was shallow, sighing and 40 to the minute. One-sixth of a grain of morphia was injected to quiet the restlessness. At seven o'clock there was a decided improvement. The lips were still congested, but the pulse had fallen to 124, and the respirations were deeper and less frequent. During the night the patient was stimulated freely by the bowel as there was some tendency to sickness, and one-tenth of a grain of morphia was given twice. At four A.M. the temperature was 96·2°, and it did not rise to normal until noon. The patient's condition remained critical for two days, showing but a slight improvement. On the 30th the patient complained of some pain in the calf of the left leg, and by next day the pain was also felt in the thigh. The whole of the limb was slightly swollen, being nearly one inch larger than the other; it was wrapped in cotton wool and raised on a pillow, no more active

treatment being required. By the 1st of April the pulse had fallen to 80, and the temperature, which had been slightly elevated, was normal. Early next morning there was a slight rigor, rather more marked than the two feelings of chill which there had been on the 23rd ult. About one o'clock in the afternoon there was a very slight recurrence of the alarming chest symptoms; pain was complained of, the face became slightly cyanosed, and the pulse rose to 100 ; next day the pulse had fallen to 86, in the evening the temperature was 100·4°, and the patient was troubled with a tickling cough with slight frothy expectoration. Until 11th April the evening temperature was usually about 100, but on that evening it rose to 102°, and the expectoration became slightly rusty; there was no marked increase in the respirations, and the pulse was from 80 to 90. Being afraid to move the patient, and as the condition was by no means alarming, no examination of the lungs posteriorly was made, but it was evident that there was a slight attack of pneumonia, as might have been expected. The temperature fell to normal on 18th April, and the swelling in the leg had entirely passed away by that time. After this date the progress of the case was quite satisfactory.

From the time of the operation abdominal symptoms were entirely absent, and it seems impossible to come to any other conclusion than that the case was one of heart-clot, and that the life of the patient was saved by the stimulation which was so promptly given by the nurse at the moment of the attack. One of the other cases occurred after an operation for the radical cure of a femoral hernia. The wound had healed without a trace of suppuration, the stitches had been removed on the eighth day, and about seven o'clock on the morning of the tenth day the patient was seized with symptoms identical with those already recorded, and the treatment adopted by the nurse was the same, brandy, mustard, and hot bottles. The patient rallied very quickly, and by 9.30 seemed to be much as usual, except that the pulse was 110. At 12.30 there was a similar though not

so severe attack. The pulse became feeble, rapid, and irregular, and the heart sounds very indistinct, the patient becoming deeply cyanosed. The gasping for breath continued for ten minutes. The patient rallied quickly, although for some days the face looked pinched and the pulse was quick, eventually she completely recovered. The third case, and strangely enough the only one of the five which occurred in Dr. Keith's practice, resembled the second one except that there was only one attack, and for several days after, the pulse continued very irregular and ran up from 120 to 130 on the very slightest exertion.

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